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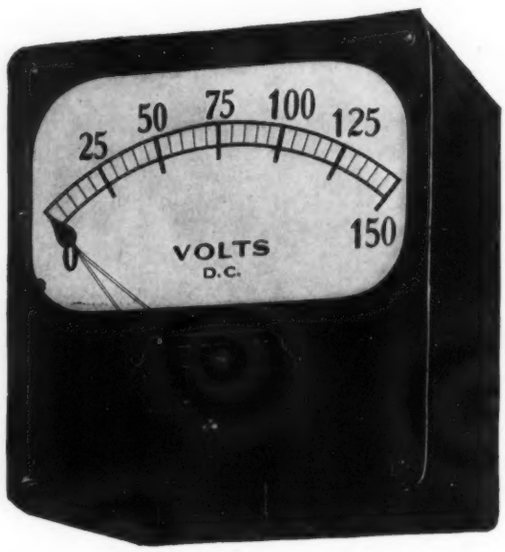

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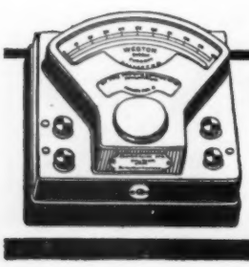

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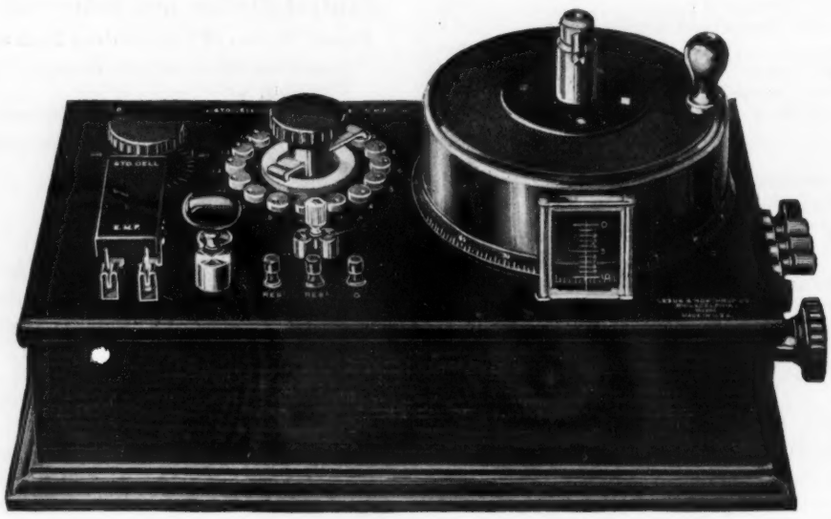

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Electrical World

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W. H. ONKEN, JR.
Editor

VOLUME 89 — *New York, Saturday, April 9, 1927* — NUMBER 15

Legitimate and Illegitimate Holding Companies

IN ITS report on the electrical power industry the Federal Trade Commission complains of "the extreme degree to which pyramiding has been carried in superposing a series of holding companies over the underlying operating companies," maintaining that such pyramiding affects the financial stability of the electrical power industry. What the commission has in mind, of course, is not pyramiding, for a pyramid is very stable. Its strictures are aimed at inverted pyramids, but we know of no holding company in the electric light and power industry of that type. The typical holding company owns all or a majority of the common stock of the underlying company, against which equity it floats its own securities, which in the aggregate do not exceed those of the controlled companies.

Every industry, however, which is up and doing attracts to it shrewd manipulators whose chief aim is to get all they can while the getting is good and then to vamose. There are few such in the electric light and power industry, and fortunately their number is decreasing rapidly. They must work fast because the economics of the electric light and power business are not such as to afford them any continuing stay. No man can pay, as some of these have done, eight times the gross, except in very exceptional circumstances, and remain in the business. Situations like these soon right themselves as some recent happenings very plainly show, and the industry may view with satisfactory relief the departure of some of these vaunted captains and kings. The legitimate holding company need fear nothing except losses by a number of its underlying companies; the illegitimate holding company is harassed by the bankers above and the companies below and pressure from both soon kills it.

Light Breaks in Maine

THE fate of legislation to permit the exportation of surplus water power from Maine is more promising at this writing than for many years. Favorable reports have been rendered upon bills designed to solve the problem of allowing surplus hydro-electricity to be marketed in other states without sacrificing regulation at home, and the action of the Governor impends. Public opinion has been rising to the support of a constructive policy, and if politics is not allowed to jettison the well-considered plans of the best-informed men of the state to enable Maine to realize a return upon vast resources at present wasted, the Pine Tree State will before long abandon her electrical isolation, join hands with her sister commonwealths for the common welfare and enter a new era of progress. Even if legislation should fail at this session, which would be deplorable indeed, gains have been made in the cause of power exportation which mark a striking advance over former conditions and which cannot be lost. Maine's opportunity has knocked before, but never with so insistent an appeal or so widespread a popular comprehension of what regulated surplus power exportation means to the general welfare.

Dreams and Facts in Water-Power Developments

PUBLIC opinion of water power visualizes a low-cost power development with energy transmitted cheaply over long distances. Few people, even in the utility business, realize the present economic handicaps to water-power development or have an accurate conception of long-distance power transmission costs when measured in terms of continuous service. The remarkable economies made in the power costs of fuel-burning stations have brought about such savings that few water powers can be developed on a competitive basis; and the dollar differentials in favor of fuel power increase yearly both on account of new economies in fuel-burning stations and because labor, materials and land values in water-power developments continue to rise in price.

Some steam stations now produce a kilowatt-hour for 14,000 B.t.u.'s or less with fixed charges based on an investment of $100 or less per kilovolt-ampere. About five years ago the corresponding figures were 22,000 B.t.u.'s and $125 per kva. Five years hence the figures are expected to be 11,000 B.t.u.'s and $75 per kilovolt-ampere. These economies and cost changes are accompanied with reductions in labor and maintenance charges and give a total cost of energy at a modern fuel-burning station switchboard which is astonishingly low. Steam-station production costs at a water-power site are competitive with water-power costs in many instances, and if, as is usually the case, the costs created by transmission lines are added to the water-power costs, the total water-power costs measured at energy delivery points are greater as a general thing than those involved in building and operating steam stations at the loads. Nor do these costs place a dollar value on the comparative service reliabilities. Yet serious attention is given to plans which involve water-power developments costing $200 or more per kilovolt-ampere and which require transmission lines two or three hundred miles long to carry the power to the loads. The mists and rainbows in a waterfall often screen the balance sheet.

It is said that from the standpoint of the conservation of natural resources all water powers should be developed, but this much reiterated statement may well be challenged. It has been accepted without careful analysis. Our present fuel resources, according to authorities cited, will last the world for from six hundred to a few thousand years—what matter a few centuries more or less? But what guarantee is there

that present fuels will be needed to produce energy a few hundred years hence? Human discovery and invention have always anticipated human needs. The pages of history show this fact and further show that all attempts to predict the future have failed miserably. No instance has been recorded where the depletion of this or that natural resource has occurred in such a way that a possible and generally profitable readjustment was not made.

And today a new trail, one which is already well broken, has been started by scientists. Dissipation of energy is being replaced by an attempt to build up energy, and the endeavor is to utilize energy fully instead of skimming the cream. In the Lilliputian universe of the atom lies the hoped-for source of a new epoch in energy control. Future generations should be able to take care of their energy requirements far more easily and more economically than does the present generation.

A common-sense attitude and the weighing of economic values seem at the present time more worthy of consideration in developing water powers than the adoption of a "slogan" or the acceptance of unweighed factors while thrilled by the rosy mists of the falling waters.

Standardization Movements Abroad

MORE than twenty foreign countries have established national standardizing bodies. The fact that nineteen of these were formed during or after the war is an interesting commentary on the need for such bodies in the modern industrial era. The general organization plan in these countries is to have a small but active national committee on policy and procedure and to have actual standards made by sectional committees. Each sectional committee is designed to be a cross-section of the industrial groups which can contribute to making the standard and includes representation of producers, distributors, consumers, public authorities and professional engineers. The national committee in general does not initiate standards but waits for the development of desirable standards through initial stages and then determines the policy and procedure to be used in making the standard. Drafts of contemplated standards are published widely for criticism and comment, and the general principle is followed of fitting standards to the needs of industry. Three of the national bodies are under the direction of their respective governments, but in the other cases the standards committee is set up and administered as an industrial committee having government representatives as members.

The success of this type of organization has been good. In Great Britain there are 475 sectional committees at work, divided into twelve main subjects covering major industries. In Germany about sixteen hundred standards have been made and more than one hundred thousand standard sheets are sold each month. More than a thousand German firms have made a systematically organized standards department a part of their administrative organization. In all these countries executive approval of the standardization plan is notable, and it receives careful executive attention and adequate financial support. There is an authority and a directness in procedure which can well be studied with a view to applying the same principles to standardization in this country.

Why Not Wired Wireless?

RADIO broadcasting interference is a serious problem for the newly organized members of the Federal Radio Commission to consider. Each station not only makes for intensive interference in a local area but also creates chaos in a very large outer region. With the present state of the art a very strict limitation in the number of stations is required to prevent unsatisfactory service to radio listeners.

Two possible developments suggest themselves which will improve the situation. One is the use of some form of directive radio or of highly damped radio waves and the other is the use of radio over house wires served already with light and power. The first possibility seems quite remote as yet, but the use of wired wireless looks very promising, especially in metropolitan areas. Multiple stations could be used as the source of radio entertainment features, and interference could be minimized. A dreamer could visualize a radio station at each utility substation with three programs or more going on simultaneously. In each home reception devices could be used to select the program desired without interference phenomena. Thus metropolitan areas could use radio broadcasting in air and by wire and afford outlets for the most complicated requirements of entertainment.

Light and power utilities may well be interested in the possibilities of wired wireless as an asset in public relations and as a revenue producer. The Radio Commission, on its part, may well be interested in this development as a means to making the interference problem simpler.

A Challenge to the Household Appliance Manufacturers

OWEN D. YOUNG, with his rare gift of words, in addressing the recent meeting of the executives of the electrical manufacturing industry, crystallized some principles that should be pondered very carefully in their relation to the development of the great domestic market for electrical equipment. Electrical men have gone far, he said, in the standardizing of machinery and of products. But standards of conduct are even more important within an industry, standards that lead to co-ordination of policy and purpose. For the greatest source of waste in industry—waste of money, effort, time and opportunity—is misunderstanding that leads to destructive competition, to dissension and to delay. The overcoming of such misunderstanding by self-government within the group is the most important object before the modern manufacturer, because when misunderstanding is cleared away problems take care of themselves and progress follows. This was the message, and although Mr. Young's theme was quite general, the thought would seem to bear particular application at the moment to the manufacturers of electric household appliances.

At the present time there is no contact between these various producers of devices for labor saving and convenience in the home. A few of the groups have their small associations, but none of them is very active and the groups themselves are not related. And yet they have a common market, since each supplies a fraction of a complete electrical equipment for the modern home. They have a common problem in the fact that they are each dependent upon the selling of the electrical idea

to the American family. And if there is any place in the electrical industry where there should be intelligent, resourceful group co-ordination and leadership, it is here in this neglected market.

The manufacturers of electrical power apparatus, supplies and radio are organized in separate divisions of the National Electrical Manufacturers' Association. It was before all their executives that Mr. Young spoke. The time has come to bring this other disorganized group together to form an "Appliance Division" of the N.E.M.A., to develop standards both of product and of conduct in this field, and to establish principles and policies that will intensify the pressure on this market and make possible a more balanced effort. Electrical men should no longer be content to sell to the home only by piecemeal in the old way. The appliance industry needs to do some collective thinking.

Another Pioneer Passes

ONE by one the pioneers of the electrical industry are joining the "great majority." Last week, in fullness of years and with half a century of service behind him, Charles William Holtzer left the scene of his fruitful labors to return no more. The company and products which bear his name form the visible monument to his foresight, faith in the future of electricity and ability to combine business skill with engineering art in a period when communication was the chief interest of the infant industry and when the wildest dreams could not envisage today's development or tomorrow's certain prospects. In "Charlie" Holtzer Europe sent the United States another immigrant citizen who blessed his adopted country with good works through many years. As was the case with others of like interest in applied science who came here and served well under handicaps almost impossible to realize now, his path was a great adventure.

This man and his contemporaries were privileged to make their personal efforts count in the development of a plastic industry, but it remains for those who follow them to deepen their own service under the more stable conditions of these resourceful times. The challenge of the unknown ever beckons, and to men like Holtzer it speaks daily. Enduring indeed are the foundations laid by these leaders and fortunate is the industry which is permitted to build upon their achievements.

Competition Over Terms

THE time-payment business of this country is estimated as reaching about six billion dollars per annum. This would indicate that the American public is only half a hop ahead of the installment collector. The savings bank deposits of this country amount to about $24,000,000,000. This would indicate that the American public is able to pay as it goes. Whether one "points with pride" to the savings or "views with alarm" the buying of goods on installments, this truth stands out: that the time-payment evil, where it is an evil, is very largely the result of a competition in terms by merchants rather than a wholesale "mortgaging of the future" by customers unable to pay cash; and where this evil exists in the electrical appliance field it is very largely because of companies which take an unenviable leadership in this competition over terms.

The apologist of lax and long terms for payment claims that the easier we make the payments the more appliances will be sold. That is platitudinous balderdash. The statistics on savings deposits show that the public has four dollars in the bank for each dollar's worth of credit extended. The lax terms are not asked for; they are offered, nay, they are actually "sold." When a washing machine is "ballyhooed" at one dollar down, it is not sold on the merits of the machine, great as those merits may be. It is not sold on its labor-saving characteristic, though no appliance saves more downright drudgery. It is not sold even on the all-inclusive idea of the electrical home or on pride of ownership. It is sold on the slogan, and on the argument, that here is a hundred-and-fifty-dollar washer for one insignificant dollar—a credit proposition so ridiculous, so unbusinesslike, so demoralizing to both trade and public, and so absolutely unnecessary from the standpoint of sales stimulation, that one is left aghast at its stupidity.

The principle is now generally accepted that a utility selling merchandise should do so at prices which do not destroy competition. This same principle would seem to apply equally in the matter of terms. When a utility uses its financial resources to grant terms which no ordinary merchant can meet, it is poisoning the well from which it must eventually drink. Time payments are unquestionably needed to sell in volume any appliance priced above $50, but the terms of these payments should be such as any conservative business man can approve. They should be such as any solvent merchant can match. Cut-throat competition in terms is no more justifiable than cut-throat competition in price.

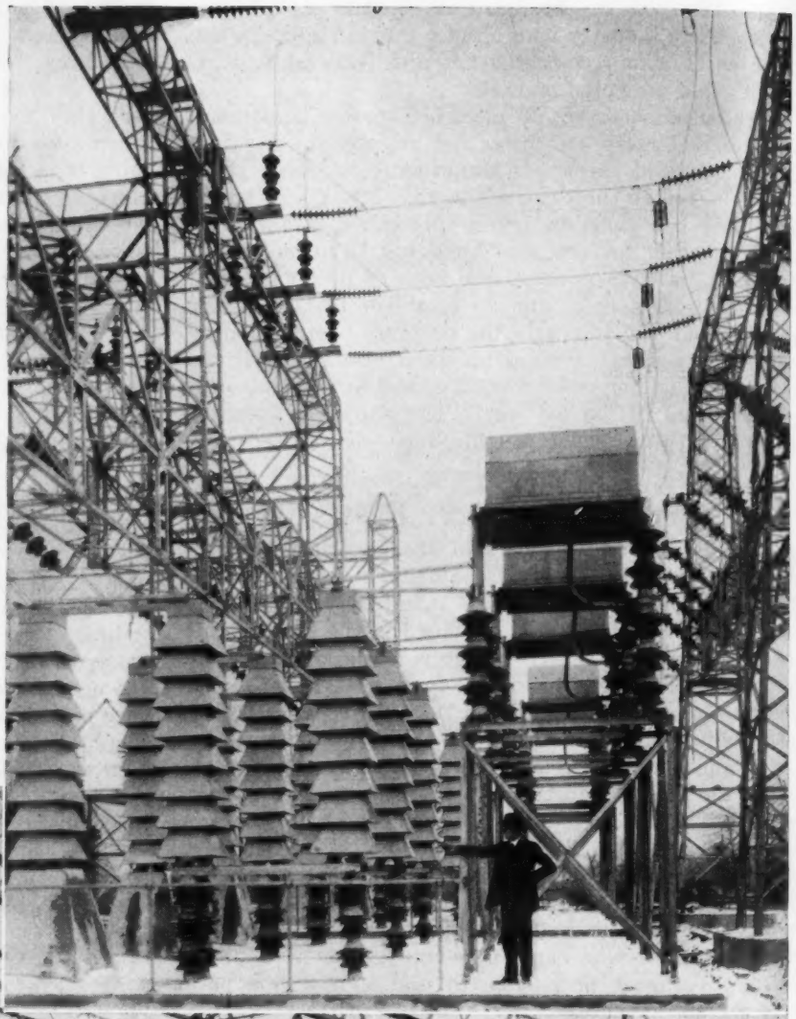
Good Lighting Again Found to Increase Production

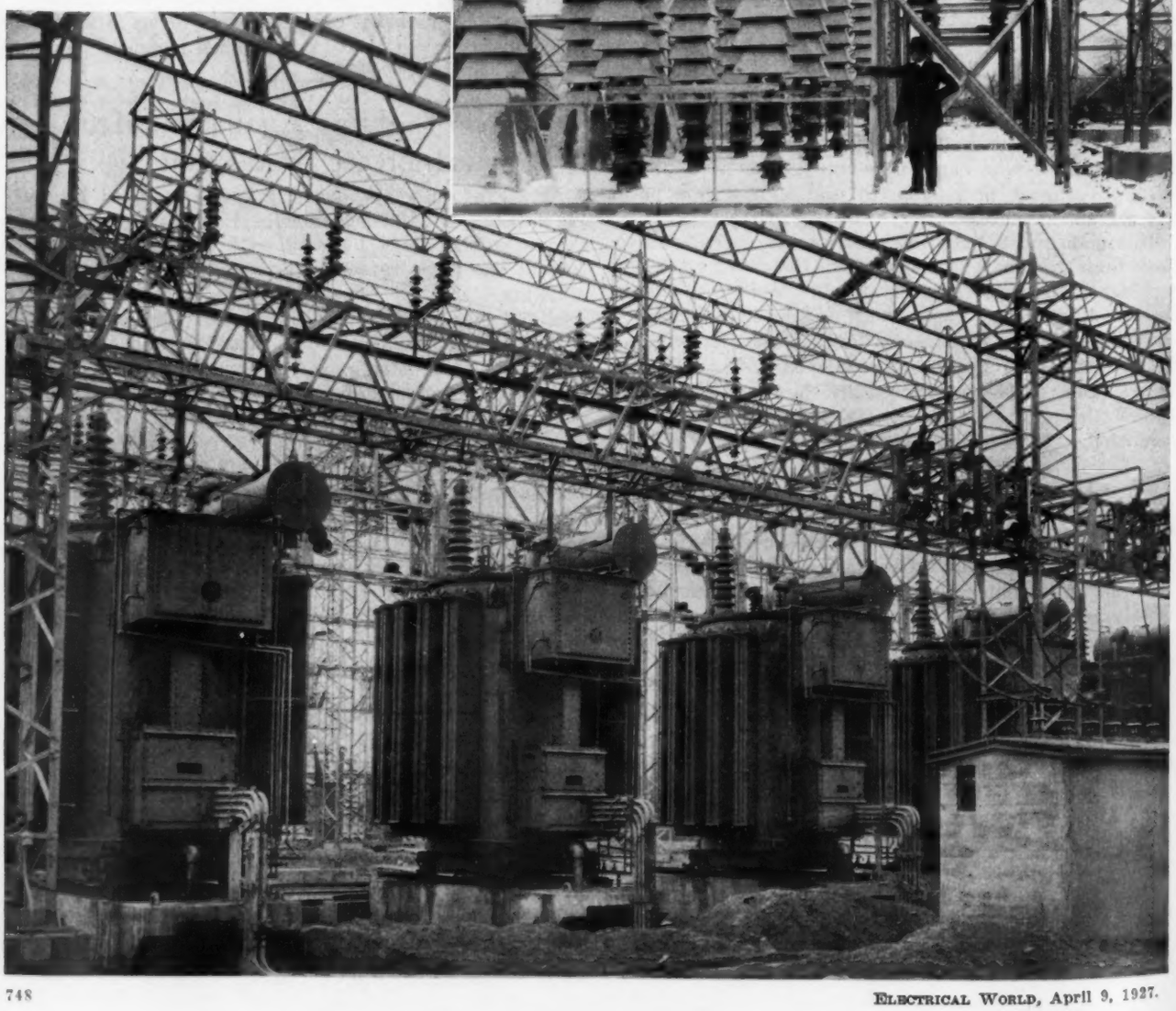
YEAR after year investigations conducted by industries and laboratories lend more power to the argument that good lighting pays excellent dividends. One of the more recent investigations on the relation of illumination to production has been completed in England by committees of the Medical Research Council and of the Department of Scientific and Industrial Research. Typesetting by hand was the work chosen, and in order to avoid week-end conditions the tests were made in the middle of the week. Intensities of artificial illumination from 1.3 foot-candles to 24.5 foot-candles were employed at five different levels. The results under daylight indoors were also studied and taken to be normal. The intensity of daylight illumination varied from 21 foot-candles to 495 foot-candles, but for the most part was not less than 50 foot-candles. It was found that the output steadily increased as the intensity of artificial illumination increased. The total errors and the percentage of inverted letters decreased. As the lighting improved the investigators also concluded that at 2 foot-candles or less about one-fourth of the possible output was lost, the number of mistakes was more than doubled and eye fatigue was materially increased. Even at 7 foot-candles, more than 10 per cent of the possible output was lost and the percentage of errors was still unnecessarily high.

These conclusions are in terms of the results under the daylight illumination; however, the data do not indicate that the maximum output was obtained even at 24.5 foot-candles of artificial illumination. Here is gratifying support for the convictions of lighting experts in this country.

Transformer Taps Changed Under Load at Cleveland 132-Kv. Station

THE output of this 132/11.5-kv. outdoor substation, which is connected with the tie line between Cleveland's Lake Shore and Avon generating stations, passes through automatic tap-changing transformers. Oxide-film arresters are used to protect the station equipment from lightning surges. To facilitate feeder relaying and eliminate arcing grounds, zigzag connected transformers with their neutrals grounded through resistors are connected to each 11-kv. bus. Remote metering and supervisory control are other features discussed on page 753.





Electric Transients and Engineering Fundamentals

A Discussion of Transient Electric Phenomena, Well Illustrated by Examples and Oscillograms—Attention Called to Trend Toward Greater Emphasis on Engineering Fundamentals

By C. Edward Magnusson* and George S. Smith†

THE factors entering into the problem discussed, as well as the solution suggested, are given more as statements *ex cathedra* than in the form of a dissertation, so as to focus the attention on the main thesis. The writers believe that whether the statements made be taken as assertions or assumptions, they will be recognized as true and in accord with existing conditions.

Although all electrical engineers are thoroughly familiar with the basic laws of direct and alternating currents applying under the constant circuit conditions, comparatively few have clear concepts of the fundamentals of transient electric phenomena. To the large majority, and this includes many members of high

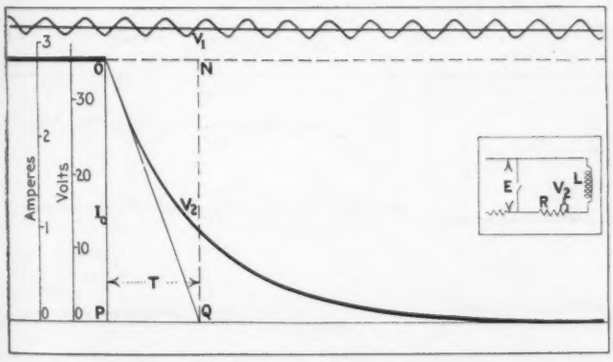


FIG. 1—DISCHARGING A MAGNETIC FIELD THROUGH A CONSTANT RESISTANCE

E = 36 volts; R = 12.7 ohms; L = 0.209 henry; I = 2.85 amp.; v = 100 cycle timing wave.

standing in the profession, electric transients in power systems are merely a jumble of destructive phenomena, without order or known sequence of events.

There is a widespread misconception as to the complexity of the fundamental laws of electric transients. True, transient electric phenomena are occasionally extremely involved, and in many cases it requires mathematical ability of a high order to analyze oscillograms or other recorded data, but by far the greater number, probably more than 99 per cent, of transients occurring in electric power systems are simple in nature and the fundamental principles on which solutions must be based are no more difficult to understand than the laws of alternating currents.

Another obstacle to a more general appreciation of transient electric phenomena that should be removed is the prevalent opinion that exceptional skill is

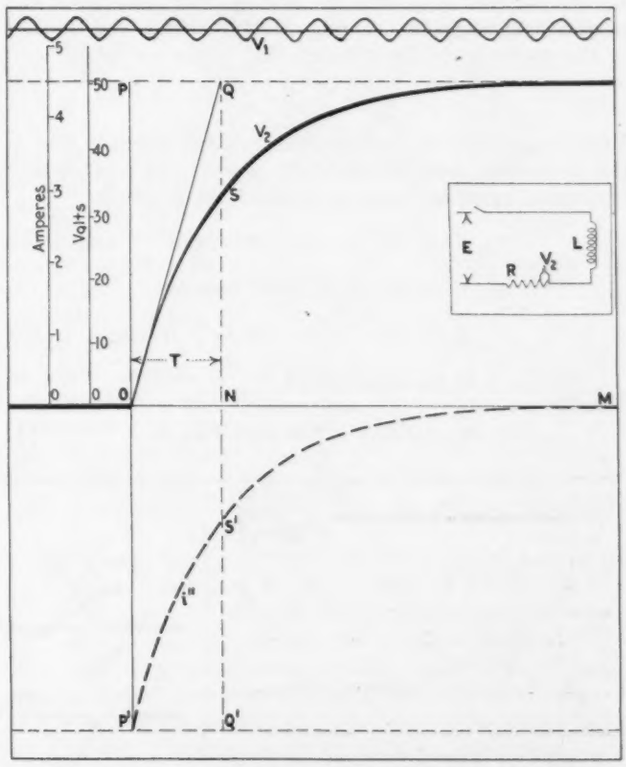


FIG. 2—MAGNETIZATION CURVE OBTAINED IN FORMING A MAGNETIC FIELD

E = 50.5 volts; R = 11.2 ohms; L = 0.209 henry; I = 4.5 amp.; v, = 100 cycle timing wave.

required to operate the oscillograph. In principle the oscillograph is a simple instrument, and sufficient skill to take fairly good oscillograms is readily acquired by engineering students who have had a good laboratory course in alternating currents.

The oscillograms shown in the accompanying illustrations were selected from a large number of laboratory experiments performed by undergraduate electrical engineering students in the University of Washington. The quantitative data and the circuit diagrams, with the exact location of the vibrator in each figure, give information of the conditions under which the oscillograms were taken.

(a) In discharging a magnetic field through a constant resistance, the magnetically stored energy is dissipated into heat. The law for this energy change, as derived from the simple circuit in Fig. 1, is of general application to electric transients and may be considered the first fundamental of transient electric phenomena. By applying Ohm's and Kirchhoff's laws

*Professor of Electrical Engineering, and Director of Engineering Experiment Station, University of Washington.
†Assistant Professor of Electrical Engineering, University of Washington.

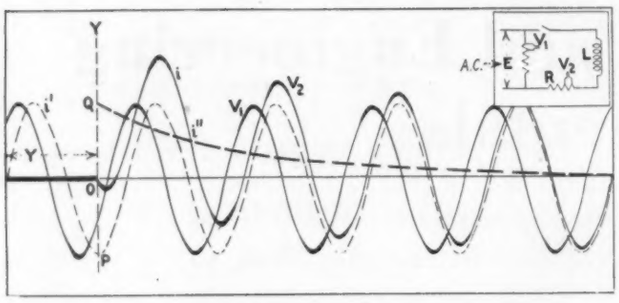


FIG. 3—SINGLE-PHASE ALTERNATOR. ARMATURE CURRENT TRANSIENT

$E = 100$ volts; $I = 1.2$ amp.; $R = 8.03$ ohms; $L = 0.201$ henry; $f = 60$ cycle.

to the circuit it is evident that during the transient period following the closing of the switch the change in the variable (i) is proportional to the variable.

$$\frac{di}{dt} : \frac{di'}{dt} :: i : i' \qquad (1)$$

From equation 1 and under the condition given in Fig. 1, the transient current, voltage, power and energy are expressed by equations 2, 3, 4 and 5 respectively.

$$i = Ie^{-\frac{t}{T}} = Ie^{-\frac{R}{L}t} = 2.85e^{-44.5t} \text{ amp.} \qquad (2)$$

$$e = Ee^{-\frac{R}{L}t} = 36e^{-44.5t} \text{ volts}$$

$$p = EIe^{-2\frac{R}{L}t} = 102.6e^{-89t} \text{ watts} \qquad (3)$$

$$w = EIe^{-2\frac{R}{L}t}\,dt$$

$$W = EI\int_0^\infty e^{-89t}dt = 0.3 \text{ Joule} \qquad (4)$$

The exponential term or damping factor, $e^{-\frac{t}{T}}$, in which T is the time constant of the circuit, is as fundamental in electric transients as the sine wave in alternating currents.

(b) The transient current, voltage, power and energy in equations 2 to 5 are scalar quantities and the algebraic sum of the permanent and transient values is at every instant equal to the actual value recorded by the oscillograph. In Fig. 1 the permanent value is zero and hence the transient and actual value are identical. In the forming of a magnetic field, Fig. 2, the permanent value of the field current is a constant. OP' is the initial value of the transient, equal to OP, the permanent value. The curves OSU, referred to PU, or $P'S'M$, referred to OM, represent the transient term. From the diagram at the time T, the actual value (NS) equals the permanent value (NP) plus the transient value (NS'), or

$$i = I' + i''$$

$$= I - Ie^{-\frac{R}{L}t} = 45(1 - e^{-88.7t}) \text{ amp.} \qquad (6)$$

(c) In Fig. 3 is shown the starting armature current of a single-phase alternator when a load is suddenly thrown on the machine. The current starts at zero value and after the transient has expired becomes the permanent load wave. The transient current factor has the same form as in the previous figures, but its initial value depends upon the epoch of the permanent sine wave at which the load switch was closed.

$$i = i' + i''$$

$$= I\sin(wt + \gamma) + I\sin\gamma\, e^{-\frac{R}{L}t}$$

$$= 1.2\sin(wt + 268°) - 1.2e^{-89t} \text{ amp.} \qquad (7)$$

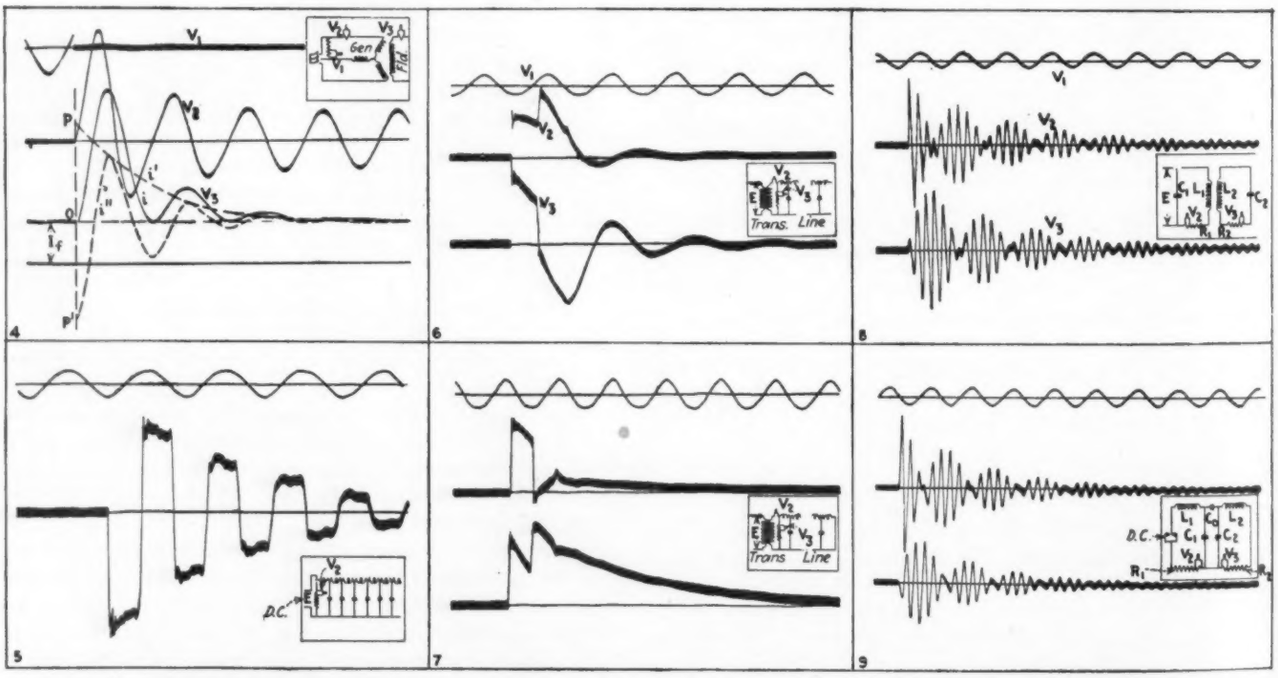


FIG. 4 — SHORT CIRCUIT ON A THREE-PHASE, STAR-CONNECTED ALTERNATOR. NO LOAD

$E = 112$ volts; $I = 11.8$ amp. under short-circuit conditions; $I = 1.33$ amp. d.c.; $f = 60$ cycle.

FIG. 5—OSCILLATION OF ARTIFICIAL TRANSMISSION LINE

$E = 500$ volts; $R = 100$ ohms; $L = 0.860$ henry; $C = 5.38$ mfd.; $v_1 = 98$ cycle timing wave. Equivalent length of line, 399 miles; No. 4/0 copper; 12 ft. spacing.

FIG. 6—TRAVELING WAVES ON ARTIFICIAL LINES. RECEIVER END OPEN

$E = 100$ volts; $R = 100$ ohms; $L = 0.860$ henry; $C = 5.38$ mfd.; $v_1 = 100$ v. Equivalent length of line 399 miles; No. 4/0 copper; 12 ft. spacing.

FIG. 7—TRAVELING WAVES ON ARTIFICIAL LINE. RECEIVER END SHORT CIRCUITED

$E = 100$ volts; $R = 100$ ohms; $L = 0.860$ henry; $C = 5.38$ mfd.; $v_1 = 100$ cycle timing wave. Equivalent length of line 399 miles; No. 4/0 copper; 10 ft. spacing.

FIG. 8—COUPLED CIRCUITS. MAGNETIC OR INDUCTIVE COUPLING

$E = 375$ volts; $R_1 = 12.6$ ohms; $R_2 = 13.0$ ohms; $v_1 = 100$ cycle timing wave; $L_1 = 0.237$ henry; $L_2 = 0.237$ henry; $C_1 = 0.45$ mfd.; $C_2 = 0.45$ mfd.

FIG. 9—COUPLED CIRCUITS. DIELECTRIC OR CONDENSIVE COUPLING

$E = 118$ volts; $R_1 = 482$ ohms; $R_2 = 443$ ohms; $v_1 = 100$ cycle timing wave; $L_1 = 0.152$ henry; $L_2 = 0.102$ henry; $C_1 = 0.69$ mfd.; $C_2 = 1.1$ mfd.; $C_0 = 0.32$ mfd.

In Fig. 4 the field current is of special interest. When the armature of a three-phase alternator is short-circuited, a constant magnetic field is formed which reacts on the alternator field. Three factors enter into the field current as recorded by the oscillograph in Fig. 4: (a) direct-current field excitation, I_f; (b) a field transient, i'; and (c) armature transient, i'', stationary as regards the armature, but rotating with respect to the field circuit.

$$i = I_f + i' + i''$$
$$= I_f + I'e^{-\frac{R_f}{L_f}t} + I''e^{-\frac{R_a}{L_a}t}\cos(wt) \qquad (8)$$

The damping factor appears in both field and armature transients, but the time constants differ depending on the resistance and inductance in the respective circuits.

(e) Under the conditions given in Fig. 5 the line represents one-fourth wave length of the fundamental oscillation. Direct measurements on the oscillogram will show that the transmission line was 399 miles long, which checks with the length computed from the measured line constants.

Traveling waves on transmission lines are illustrated by the oscillograms in Fig. 6 with the receiver end open and in Fig. 7 on the same line with the receiver end short-circuited. Note the conversion of the traveling wave, with current and voltage in phase, to line oscillations, with current and voltage 90 deg. out of phase after the energy impulse has traveled to the receiver end of the line and back to the generator. Comparing the current or the voltage waves in Figs. 6 and 7, it is apparent that the phase relation of the reflected waves differs by 180 deg. in the two cases.

(f) The oscillograms in Figs. 8 and 9 illustrate the transfer of energy to and fro in coupled circuits. In Fig. 8 the energy transfer between the primary and secondary is accomplished magnetically, whereas in Fig. 9 a similar transfer is made dielectrically. During each transfer part of the electric energy appearing alternately in the primary and secondary circuits is dissipated into heat and hence the successive resonant oscillations decrease in magnitude.

It is now generally recognized that the main purpose of engineering students while in college should be to gain insight into, and understanding of, the fundamentals of engineering—that is, basic physical laws, by and under which engineers work, live and have their being; and to acquire a fair working ability to apply these laws to quantitative practical problems. Engineering students should also acquire proficiency in the handling of professional tools, the most important of which are mathematics and English, both oral and written. The present trend in engineering education is strongly in the direction of greater emphasis on engineering fundamentals, better working knowledge of elementary mathematics, more effective command of English, with less attention to engineering practice.

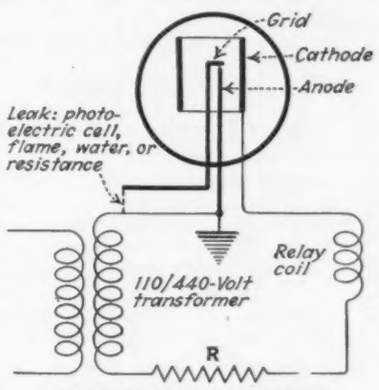
There can be no question as to the far-reaching, practical importance of transient electric phenomena in all branches of electrical engineering, and if the propositions already stated be true and in accord with present conditions, it follows that greater emphasis should be placed on the basic principles of electric transients in all engineering colleges and technical schools. In fact, the curricula leading to the bachelor's degree in electrical engineering should include courses on transient electric phenomena as an essential part of the engineering fundamentals that college students should master.

Grid-Glow Relay

A Three-Electrode Gas-Filled Tube in Which Glow Discharge Is Controlled by Gradient Established by Grid

A NEW type of relay, which can be actuated with as small an expenditure of power as one-billionth of a watt and still provide sufficient power in its output circuit to operate ordinary commercial relays, has been developed by the Westinghouse Electric & Manufacturing Company. This new device is known as the "Grid-Glow" relay.

Externally the relay looks like a radio vacuum tube. Likewise it has three electrodes—an anode, cathode and grid. Here the similarity ends. The tube contains an inert gas—neon in the present tubes, but argon will also serve. There is no filament to burn out, the anode being a straight wire inclosed, except for the tip, in a glass tube and placed concentric with the cathode, which is an aluminum cylinder, in present models. The grid consists of another wire, also inclosed, except for one end, by a glass tube and placed adjacent to the anode. The exposed end of the grid is bent at right angles to the remainder so it extends over but slightly separated from the tip of the anode.



CONNECTIONS FOR SECURING SENSITIVE CONTROL

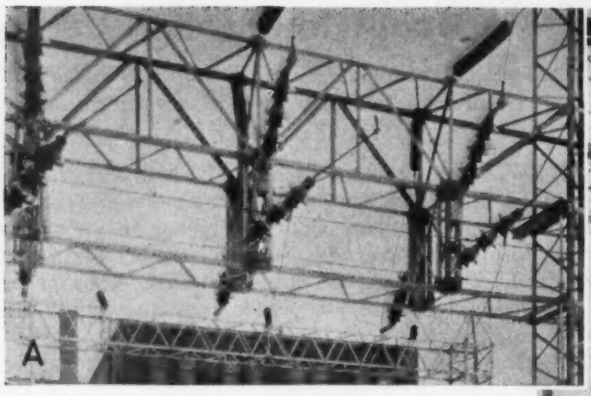
The theory of operation is as follows: When voltage is impressed between anode and cathode with the grid insulated, electrons are accumulated upon the grid. This accumulated charge lowers the gradient between grid and cathode and increases it between grid and anode. The gradient between grid and cathode is too low to cause a discharge, and the gradient between the grid and anode, although very high, does not cause a discharge because of what is known as the short-path principle.*

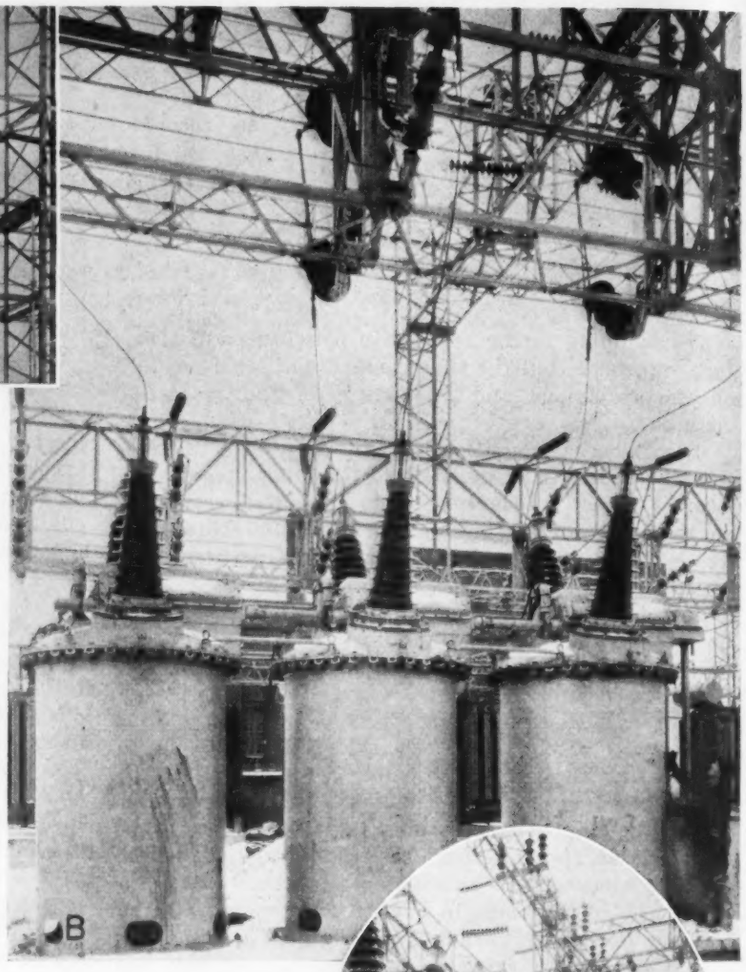
If the grid charge can be removed in any manner, the voltage gradient is shifted in such a way that the tube will pass current at a fairly low voltage—for instance, 200 volts. This charge can be removed by means of a resistance or a capacity. The resistance may take the form of a photo-electric cell for instance, or it may be a flame, or any substance that has any degree of conductivity.

When potential is impressed between the anode and cathode with the grid insulated, no current will pass unless the voltage exceeds approximately 600 volts. If a voltage of approximately 440 volts is impressed and the charge that accumulates on the grid is permitted to leak away through a resistance or capacitance, a current will pass after a certain critical value of leakage occurs.

D. D. Knowles, research engineer of the Westinghouse Electric & Manufacturing Company, is the inventor of the relay.

*This principle is that if the mean free path between electrons in the gas is greater than the distance between electrodes, no discharge can take place at ordinary voltages.





132-Kv. Switching and Neutral Grounding at Latest Cleveland Substation

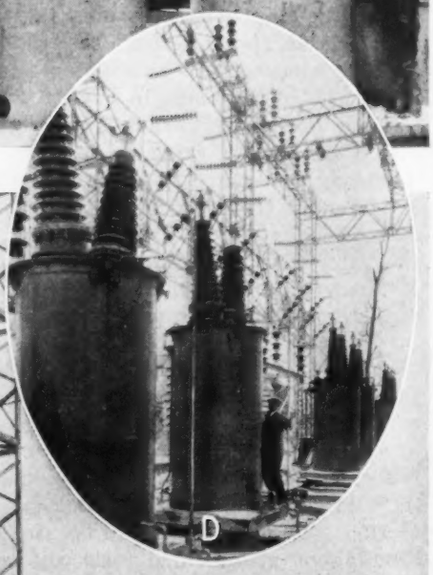
THE accompanying illustrations show some features of the 132/11.5-kv. Clinton substation of the Cleveland Electric Illuminating Company, which is equipped with tap-changing (under load) transformers. These transformers, as well as the lightning arrester installation, are shown on page 748.

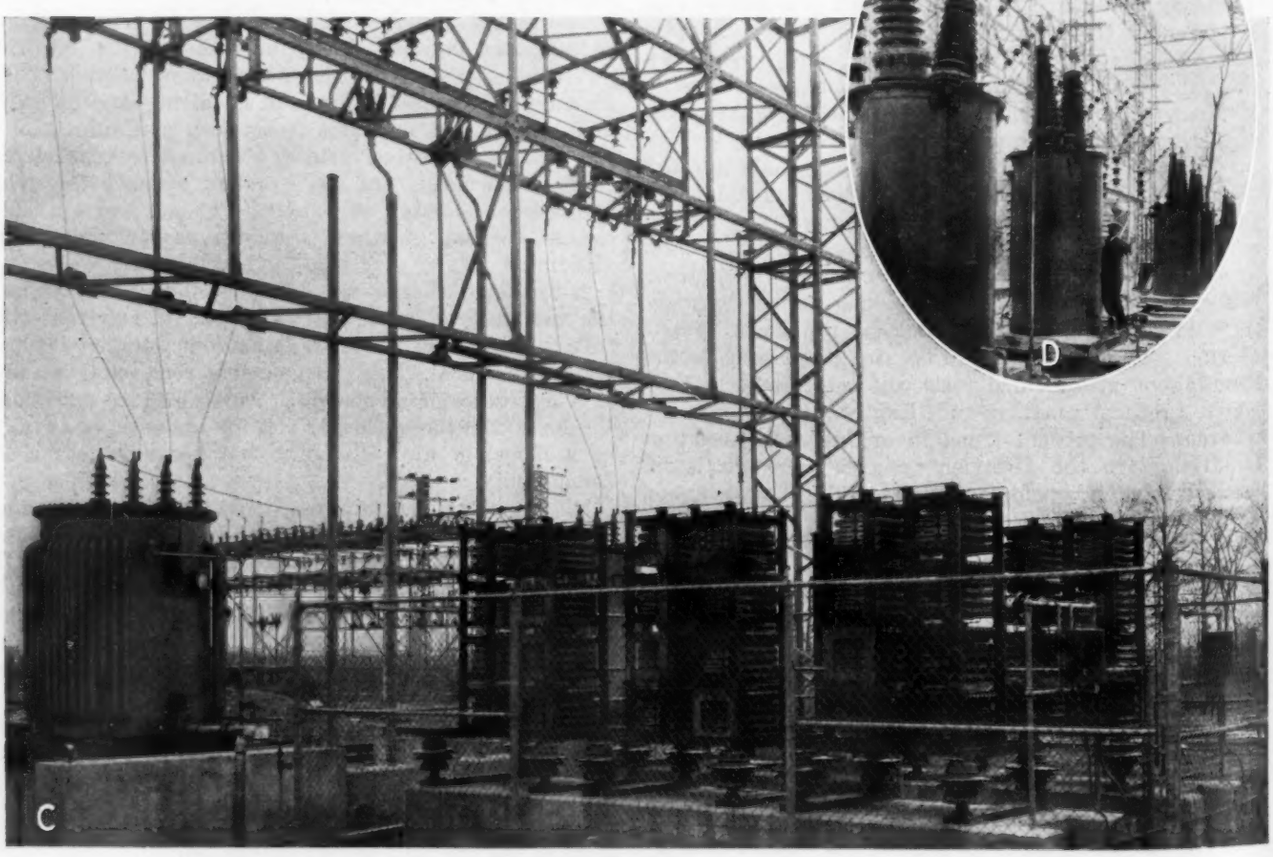
A—132-kv. disconnecting switches over 36,000-kva. bank of transformers.

B—400-amp., 132-kv. oil circuit breakers and disconnecting switches.

C—Grounding transformers and current-limiting resistors.

D—132-kv. potential transformers.





Cleveland's 132/11.5-Kv. Substation

Embodies Tap Changing Under Load, Flexible Switching, Oxide-Film and Ground-Wire Protection, Ground Relaying, Remote Metering and Supervisory Control

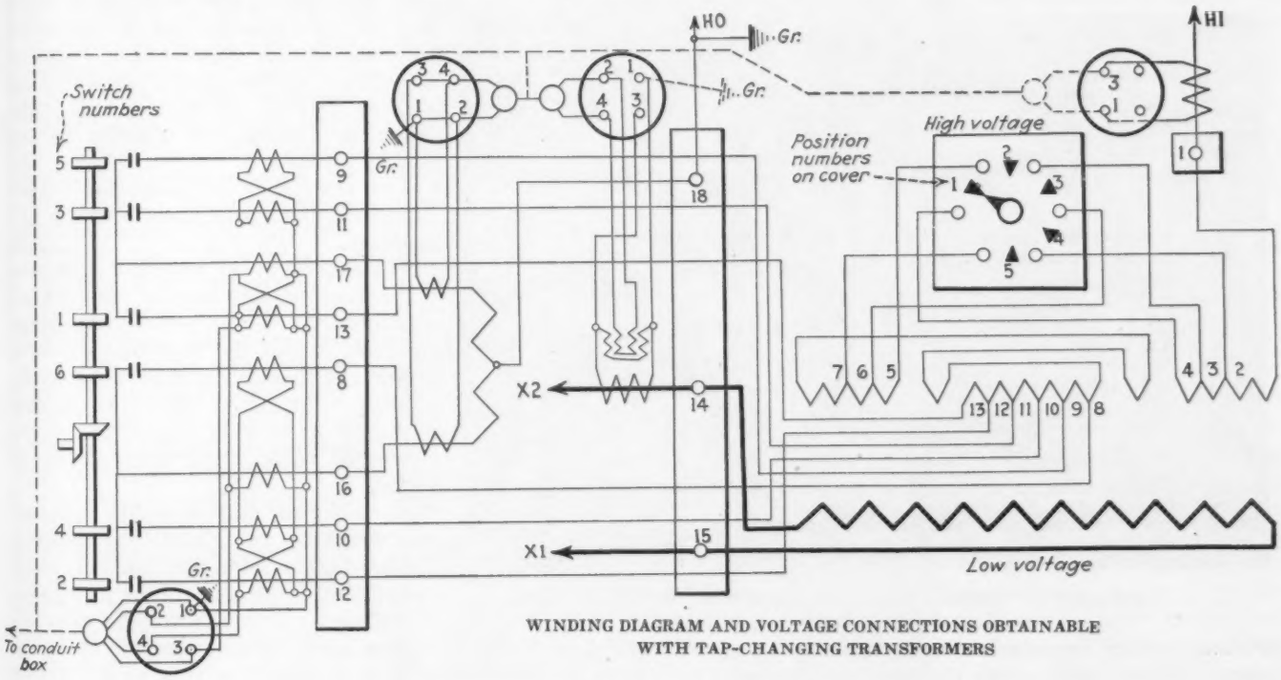
By H. L. Wallau

Electrical Engineer Cleveland Electric Illuminating Company

A NEW substation receiving energy at 132 kv. and stepping it down to 11.5 kv. was placed in service early this year by the Cleveland Electric Illuminating Company. With the exception of a few 11-kv. circuits supplying heavy industrial loads in the immediate vicinity, the output of this station (Clinton Station) is transmitted entirely to a westerly group of distribution substations originally supplied by direct cables from the company's Lake Shore generating plant, situated eight miles east of Clinton.

Energy is received over two No. 4/0 copper 132-kv. lines about nine miles long from a sectionalizing and switching station (known as No. 3 or Fowles Road), through which pass the two high-tension circuits forming the tie loop* between the company's Lake Shore generating plant and its new Avon* plant. At Clinton station each incoming line passes directly through the necessary disconnecting switches and a General Electric FHKO-39, 400-amp., 132-kv. breaker to a bank of three Westinghouse 12,000-kva. automatic tap-changing transformers connected in Y on the high side with the neutral solidly grounded and in delta on the low side, giving a ratio of 132(76Y)/11.5 kv.

On either side of the high-tension breaker there has been installed a transfer bus to which a spare breaker may be connected to facilitate the inspection and maintenance of the breakers normally in service. An oxide-film arrester on each line protects the high-tension side against lightning surges, and these are supplemented by an overhead ground wire on the tower line. The low-tension leads of each transformer bank pass through disconnecting switches into a cable tunnel, through which they enter the building where the 11-kv. buses, breakers, control equipment, etc., are located.



WINDING DIAGRAM AND VOLTAGE CONNECTIONS OBTAINABLE WITH TAP-CHANGING TRANSFORMERS

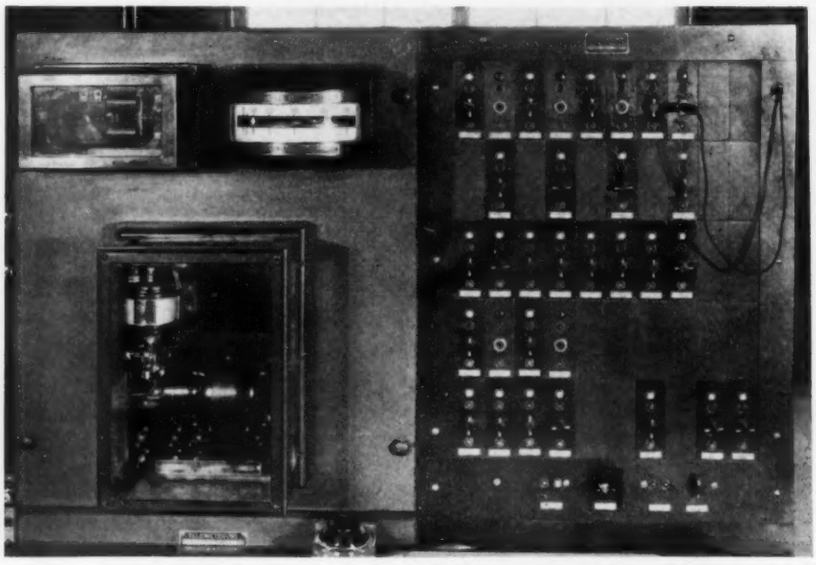
To facilitate the relaying of the outgoing 11-kv. underground feeder circuits, and also to eliminate arcing grounds, two Westinghouse zigzag-connected grounding transformers, situated in the yard, are connected to the 11-kv. buses through oil breakers. The neutral point of each transformer is connected to ground through a 3-ohm outdoor resistor. Incorporated in these grounding transformers are three potential transformers connected to give a pilot-light indication in the station. The failure of one of these lights indicates an open phase, which may be due to an open lead, open disconnecting switch or to an oil breaker not contacting properly. The outdoor disconnects, being gang operated, are each provided with an auxiliary switch on the operating mechanism which lights a red pilot lamp fed from the direct-current control circuit when

*The new plant and high-voltage interconnecting loop were described in the Aug. 7, 1926, issue of the ELECTRICAL WORLD.

left open. These precautions are necessary to insure that the station will not be operated without a ground on the low-tension side. Further feeder protection is obtained by the use of 3 per cent, 200-amp. reactors in each leg.

Clean and dirty oil tanks are provided for both transformer and breaker oil, the high-tension equipment being permanently piped thereto. Centrifugal separators and oil-testing facilities are included. The tanks are housed in a building the major portion of which is below ground.

Each transformer is connected on the low-tension side through a General Electric H-209 breaker to each of two buses. These buses and their associated equipment are housed in separate masonry structures. The two buses associated with a transformer form a bus section, which is housed in a fireproof section of the building, separate from all other bus sections or other equipment installed. Each set of buses is arranged so that it can be tied to the corresponding set of the other



SUPERVISORY CONTROL PANEL SHOWING TELE-AMMETER

section through two similar breakers in series. Feeder circuits in each section are provided with General Electric H-203 bus selectors. Provision has also been made for the later installation of synchronous condensers. These will be of such capacity as will permit the delivery from each bus section of 45,000 kva. of 70 per cent lagging power factor load without exceeding the rated load of 36,000 kva. on the bank feeding it.

The transformers are provided with one 5 per cent full-capacity tap above and below normal. These are in the high-tension winding and are selected by means of a hand-operated ratio adjuster with the transformer de-energized.

VOLTAGE REGULATED UNDER LOAD

The voltage regulation under load is obtained by cutting out turns of the high-tension winding by means of tap changers. The turns controlled by the tap changer consist of five groups located at the nuetral end of the high-tension winding, which, together with the mid-voltage point of an auto-transformer, give voltage changes of 2 per cent on the low-tension side, with a total available range of 20 per cent. The tap changers are operated under oil, but are housed externally to the transformer itself. The operating mechanism housing is mounted below the tap-changer housing and the two are connected by insulated shafts also protected from the weather. Electrical interlocking connections are provided between the mechanisms of the three units comprising one bank. Position indicators at the transformers and on the operating panels show which tap is in use.

Protective auto-transformers are bridged in by the mechanism when changing over from one tap to another in order that the primary circuit may remain closed. These, as previously stated, are also used to obtain the mid-voltage between tap points.

The tap changers may be operated manually or electrically at the transformers by manual electrical remote control from the control panels in the station or by automatic electrical remote control from a contact-making voltage relay responsive to the voltage changes of the 11-kv. bus. Parallel operation of the banks is also provided. The position of both sets of tap changers can be controlled by the operator from either panel or by either of the two contact-making voltage relays. Protective and anti-pumping devices are included in the control circuits.

The station is designed for future increases using equipments of similar capacity.

The control room, which is separated from the rooms housing the 11-kv. switchboards, is provided with large windows facing the high-tension yard, giving the operator a clear view of the outdoor equipment. Similar windows will give a view of the synchronous-condenser room when this building is added.

Normally the station will be operated with the transformer banks paralleled on the low-tension side, the low bus being maintained at plus or minus 2 per cent of 11,500 volts by the voltage relay.

The Fowles tie-loop sectionalizing station, being a non-attended station, is arranged so that each through line is protected by an FHKO-39 breaker on either side of the cross-buses to which the Clinton lines may be connected. This allows a section of line to the east or west of Fowles Road to drop out because of a fault without interrupting the Clinton supply. The Clinton lines also have breakers at Fowles. All of these breakers and their associated air-break disconnects are electrically operated and are remotely controlled from the Clinton station by means of a General Electric supervisory control system.

Tele-ammeter readings of the current passing through any one of the six breakers are also available at the Clinton station.

In addition, the Clinton operator may control the battery-charging set at Fowles, and receives indications of the positions of all remotely controlled breakers and switches and other indications of operating value. A telephone circuit is also available between the two stations over the supervisory system, thus allowing direct communication between an inspector or patrolman and the Clinton operator.

Development of Interconnection in Central Maine

Benefits of Long-Established Policy Should Be Extended to Surplus Power Exportation—Lower Rates, More Reliable Service, Reduction of Waste and Attraction of Industries Follow Installation of Tie Lines

By George S. Williams
Vice-President and General Manager
Central Maine Power Company, Augusta, Me.

FROM the beginnings of hydro-electric development on the Central Maine system it has been evident that the interconnection of widely scattered plants has been a benefit to every community served and should be continued and enlarged by a liberal policy with respect to interstate transmission. It is interesting to note how the company's earliest interconnections with neighboring plants and systems led to the improvement of service and to lower rates and how the fundamental economic principles involved in this work have underlain all that has been done. As far back as 1907-08 an interconnection was established between Augusta and Gardiner by a 10,000-volt line, which enabled Gardiner to draw upon the power resources of the Kennebec Light & Heat Company at Augusta, which amounted at that time to about 500 hp. in water and 700 hp. in steam. In 1909 a line was built from Waterville to Augusta, and after it was completed it was found that surplus power from the Fort Halifax hydro-electric plant near Waterville could be sold at Augusta at a lower price than the switchboard cost of the Kennebec company, and this led to the consolidation of the plants under a single company. As a result of this consolidation, energy for lighting in the Augusta district was reduced from 15 cents to 10 cents per kilowatt-hour and a few years later to 9 cents, the power rates being reduced from 7 to 4 cents and even 2 cents in larger quantities.

G. S. WILLIAMS

In 1910-11 a line was built from Waterville and Augusta to Rockland and a new 33,000-volt line was erected between Augusta and the Farmingdale steam plant. All of these interconnections resulted in lower prices and guaranteed service to the consumer. After various other extensions a line was built in 1916 between Farmingdale station and Bath. Due to war work the population of Bath increased from 9,000 to 16,000 in about three months, and transmitted electric power enabled important work to be done on an unprecedented scale.

100 Inefficient Waterwheels Replaced

About 1919 the Central Maine Power Company completed its Weston development of 20,000 hp. at Skowhegan. At that time there were approximately 100 waterwheels working inefficiently on both sides of the falls of the Kennebec in this town, and it was common talk that the company was acquiring these property rights to build a power station that would merely employ six or seven men and ship all the energy outside the community. Immediately after this development was completed, the Maine Spinning Company, which had been operating a small business in Skowhegan, increased its business to such an extent that a larger mill was required, using much more power. Efforts were made by a number of Massachusetts cities to persuade this mill company to locate in their precincts, but the low power rates we were able to offer so near the Skowhegan plant kept this industry in Maine. We can always sell power cheaper in Maine than outside on account of the transmission losses in the latter case.

The Androscoggin Electric Company had reached the limit of output at its Deer Rips plant, above Lewiston, in 1920, and only a small steam reserve was available to meet the growing power demands of this district. This company realized that in order to develop more hydro-electric power efficiently a plant of considerable size should be built. The fixed charges on such a plant were too great for so small a company to stand; there was no market for its surplus and therefore it was de-

cided to consolidate with the Central Maine system. A tie line was built from Lewiston to Farmingdale in this year. Previously the Deer Rips station had never generated more than 20,000,000 kw.-hr. in a year, but as soon as this plant was tied into the Central Maine system, which enabled Deer Rips surplus power to be sold, the plant generated 41,000,000 kw.-hr. in 1921. This tie line enabled us to ship power to Lewiston by day and to receive power from Deer Rips by night, utilizing the resources of both systems, insuring more economical operation and demonstrating that the load conditions

Possible output of all hydro-electric stations with same water conditions as 1926
Surplus hydro power
Est. 1927
Actual load 1926
Jan. Feb. Mar Apr. May June July Aug. Sept. Oct Nov. Dec.

KILOWATT-HOUR LOADS AND 1927 ESTIMATED WASTE HYDRO WITHOUT EXPORTATION FROM CENTRAL MAINE SYSTEM

are never the same in any two communities at the same time. Incidentally, about this time our lines were extended from Lewiston into Oxford County and as a result of consolidation rates were reduced for lighting from 12 cents to 10, 8 and 6 cents per kilowatt-hour.

Interconnection with the Cumberland County Power & Light Company of Portland was established in 1924. There has never been any contract between the two companies, the arrangement being simply to sell energy back and forth at a small profit to both utilities. If we have surplus hydro power, Portland will buy it in preference to generating by steam, and if our hydro conditions are poor, we can buy from Portland at a much lower rate than we can generate it in our own steam plants, as the Portland company's steam plant is on tidewater and its fuel is less costly than ours. There have been several emergencies when if we had not had this interconnection we would have had to dump two-thirds of our load. In one case, due to anchor ice, we received about 11,000 hp. over this line for less than an hour and saved a complete shut-down of the Central Maine system. Soon afterward the Portland company had a similar experience.

The next step that seems advisable is to extend our transmission lines toward utilities in New Hampshire, which in this case calls for transmitting energy across the state line. This is regarded by some as against the state law. If no state line existed, no one would give this a thought; it would be the practical thing to do and in direct line with the progress of the last twenty years.

In order to have cheap electric power available, so as to attract new industries into Maine, our company would like to start work on its Bingham development of from 150,000 to 200,000 hp. on the upper Kennebec River, representing an investment of certainly $7,000,000 or $8,000,000. As soon as this is done, however, the plant acquires an overhead of not less than $1,000,000 per year, and no sane organization can undertake such a project unless it can dispose of surplus power pending its use by industries drawn to the state by the low cost and continuity of this service.

Claims lately made to the effect that there is no surplus power now available in Maine are easily disproved by the accompanying diagram. In 1926 the Central Maine company generated 183,000,000 kw.-hr. Its total estimated output for 1927 is about 200,000,000 kw.-hr., of which the new station at Gulf Island, near Lewiston, will produce about 90,000,000. The engineers of this company estimate that in 1926 there was wasted approximately 75,000,000 kw.-hr. and that in 1927 this total will rise to more than 125,000,000. At 5 mills per kilowatt-hour this means a waste of $375,000 in 1926 and a possible waste of more than $600,000 during the present year.

During the last twenty years the interconnection and expansion policy of the company has always resulted in greater reliability of service, which is a vital necessity at this time and has made it possible for new industries to be established. The public is daily gaining confidence in its utilities, regardless of political propaganda. The Central Maine Power Company has about 14,000 stockholders, 70 per cent of whom are Maine residents; its property account is about $40,000,000, and it pays more than $1,000 per day in taxes to the municipalities which it serves. The policy of interconnection is in the public interest, and the extension of this policy to permit the sale of surplus energy outside the state will benefit all concerned and conduce to lower rates and better service throughout its territory.

Railroad Electrification Goes on in England

GOOD progress is reported from England on the electrification of the old London, Brighton & South Coast Railway suburban area and a small portion of the old Southeastern & Chatham lines. The scheme includes the equipping of the 127 single-track miles of existing "overhead" electric system with direct-current third-rail and the laying of third-rail for 105 single-track miles of railway at present operated by steam. In all, 232 track-miles, exclusive of sidings, are being electrified at a cost of $18,750,000. Ultimately the overhead equipment will be eliminated and all trains will be run on the third-rail system, thus standardizing the suburban equipment and track on all three sections of the Southern Railway, of which the lines mentioned above form part.

Simple Inducement Rates *Are Essential to Large Service Usage*

Merchandising Methods Can Be Improved and Sales Effort Increased, but Real Necessity Is to Sell Service, Not Kilowatt-Hours —An Inducement Rate Based on Number of Rooms and Class of Service Is Proposed

By E. A. Graham
Servel Corporation, New York City

WHEN the sale of electrical devices fails to keep pace with the growth in sales of other articles and when the appliance saturation of wired homes reduces, there is something fundamentally wrong, declares E. A. Graham of the Servel Corporation. Although he admits there is room for improvement in merchandising methods, this is not the sole fault; furthermore, there is no lack of utility in household appliances and first cost should not be a stumbling-block, considering what the public spends for other articles. Mr. Graham contends that the trouble is due to the past practice of selling kilowatt-hours instead of service. As a remedy he proposes an inducement form of rate based on number of rooms and class in which the household service falls, citing advantages that may obtain.

Experience here and there already shows the value of inducement forms of rates if the public is simultaneously shown the increased economy and comfort that can be secured from a small additional expenditure of money. Although some companies are convinced of the value of a room basis for taking care of service or demand cost, others are just as opposed thereto because of the complexity added. Anything that can be done to induce people to take further advantage of electric service is a goal to be sought, but in so doing the simplest rate structure should be the aim.—*Editor.*

THERE must be something fundamentally wrong when the sale of electrical devices fails to keep pace with the growth in sales of other articles and when the relative saturation of appliances for wired homes is lower now than it was ten years ago.

Undoubtedly there is room for improvement in merchandising methods, as the average electric shop does not compare very favorably, at least in appearance, with progressive shops selling other lines of merchandise. But this alone is not responsible, as can be attested by the experience of those who have installed expensive shops and still fail to do a satisfactory business. It cannot be the lack of utility or even of appearance, for most electrical articles stand in a class by themselves in these two respects. The first cost of the electrical devices cannot be the main stumbling-block, as the public readily spends more for other articles of less utility and higher relative cost.

The merchandising of electric service is a prerequisite to the selling of the device that makes that service available. The public is quite thoroughly sold on the convenience of electric service, but not so thoroughly convinced as to the economy of this service. Domestic rates with a large block of kilowatt-hours at a high lighting rate do not provide any encouragement, and the use of two meters to take care of different classes of service is confusing and illogical.

It therefore seems to the writer that the most important step in the merchandising of electric service in the home, and hence in the promotion of the sale of electric devices, lies in the establishment of a logical and reasonable rate basis to promote the use of the devices. An editorial appearing in the Sept. 4, 1926, issue of the ELECTRICAL WORLD under the caption "The Cat, the Kittens and Electricity Rates" set forth graphically the inconsistencies of most electrical rates for domestic use. That the leaders of the electrical industry realize fully the handicaps imposed by present rate forms is indicated by many articles and interviews appearing in the current technical press.

The user of electricity makes the market both for the current and for the device that makes the service available to him, so any consideration of this matter should start with the user. He is uninformed on the complex relations entering into the preparation of rates, and in fact is interested only in the service he receives and what it costs him per month. He is, however, somewhat puzzled when he puts a range in his house under a two-meter rate arrangement and observes that from the distribution lines in the street a single set of service lines comes into his house to give birth there to two or more different kinds of electricity, one used for lighting, another used for cooking and perhaps, because "neither of the barn door holes fits the new kitten," another kind for refrigeration. It should require no extended arguments to convince one that the electricity user would prefer a rate basis that would permit him to use electricity at any place in his house through a single meter and pay for it on a basis of the class and value of the service rendered.

SELL SERVICE, NOT KILOWATT-HOURS

The single-meter rate has been in force in one form or another in some utility properties for a long time and has proved its value as a business developer and a good-will promoter. Why, then, has it not received more universal adoption? Is it not possible that in all of our consideration of electricity rates we have been thinking too much about selling kilowatt-hours and too little about merchandising electric service? The customer doesn't buy a kilowatt-hour; he buys lighting service and expects to receive a continuous and uniform supply of that service; he buys cooking and refrigeration service, etc., and expects the same class of service as for lighting plus the mechanical service of looking after the device, and there is no reason why he should not pay for this latter service in the rate, which he could not do if we consider only the kilowatt-hour in fixing the rate.

Any one at all familiar with such matters knows that the more or less universal monthly minimum of $1 does

not even cover the "customer cost" of doing business, to say nothing of providing for fixed charges, production cost, etc. The very large percentage of the domestic users of electricity who fall in this classification are riding on the backs of the other users of electricity, while they themselves are failing to secure the benefits from the electric servant that they should receive. The trouble is that they have been buying kilowatt-hours; they have not been sold "electric service." Naturally they are not going to add to their household budget if they can help it, but if they can be shown where they can transfer present actual expenses for cooking, water heating, refrigeration, etc., by inconvenient, obsolete methods to the modern, clean and convenient electric method, the problem of a monthly minimum will automatically cease to be a problem. This requires, of course, a simple, easily applied unified rate for all electric service in the home.

Let us see what all this means to the people most interested—the electric service companies—for, after the appliance manufacturers, dealers, etc., have collected their sales profit, if any, they are through, whereas the electricity supply company secures a return in perpetuity from the use of the device.

A keen foreign observer, when asked for his impressions after an extended inspection trip over most of the larger public utility properties, replied: "The American public is the greatest buyer of electricity in the world; when the electric service companies begin to sell 'electric service,' they will really begin to grow and earn money."

The ELECTRICAL WORLD in its very comprehensive survey of the light and power business of the United States in the May 8, 1926, issue showed this fact up most clearly. The entire article is of the deepest interest to manufacturer and public utility executive alike, and as certain of the tabulations are pertinent to the present discussion, the writer has analyzed them below.

COMMENTS ON POTENTIAL BUSINESS

The first table in this article summarizes actual and possible business from the residence consumers. The unit figures from this table are given below. It is interesting to note that on the basis of the possible revenue from actual residence consumers there is obtainable an annual domestic revenue approximately twice the present total annual revenue from all classes of business:

Per Residence Consumer	Unit	Actual	Possible
Average annual use	Kilowatt-hour	365	5,754
Average residence bill	Dollars yearly	27.89	202.88
Average residence bill	Dollars monthly	2.32	16.90
Average per kilowatt-hour sold	Cents	7.64	3.52
Installed capacity	Kilowatt	1.5	17.31
Maximum demand, total load	Kilowatt	0.3	3.0
Load factor	Per Cent	13.9	22.0

The figures of "possible" earnings are based on the requirements for electricity to give effective service in a six-room "Red Seal" house. They appear very optimistic until they are grouped as below according to general classes of service and then are compared with what most people would have to set aside in their regular budget to pay for service far inferior to that given by electricity:

Class of Service	Avg. Rate per Kw.-Hr. (Cents)	Monthly Use (Kw.-Hr.)	Monthly Cost
Lighting	6	31.2	$1.88
Radio	6	6.2	0.38
Housekeeping appliances	6	34.0	2.09
Refrigeration	5	58.3	2.91
Laundry	5	24.8	1.27
Cooking	3.5	125.0	4.37
Water heating	2	200.0	4.00
Total	3.52	479.5	$16.90

No one of the groups mentioned appears to be so very formidable. Who would not pay 38 cents a month to keep the radio going, or $2.09 to wash all the dishes, sweep the floors, toast the bread, make the coffee, etc., or $2.91 a month for perfect refrigeration service, and so on through the entire list, which, by the way, is outlined in much greater detail in Table IX of the article referred to?

LESSON IN AUTOMOBILE SALES

The owner of the six-room house will undoubtedly have a car which will cost him at least $30 a month to keep in commission. There is no question as to which service—electricity or automobile—gives him the more value for his money; but he has been thoroughly sold on automobile service. In every one's mind is the picture of the open road, the glistening car drawn up alongside the country club and many others persistently shown in the national advertising. There are more than 19,000,000 automobile licenses in the United States as compared with about 15,000,000 domestic users of electricity, and the automobile industry is about half as old as the electrical industry.

The automobile industry grew by developing mass production and giving the customer the benefit in improved quality or lower price of the savings consequent to volume production. The electrical industry has grown by selling kilowatt-hours, a unit of energy but not of service. The average rate has been consistently reduced and the quality of the service steadily improved, but notwithstanding this and the great utility of electric service, the average expenditure for and the effective use of this service has not increased materially in the American home, nor have the larger public utilities improved their load factors materially during the last ten years.

The automobile, however, is rapidly reaching the assumed saturation point of a car per family, so the time is now ripe to make a concentrated drive to provide the home with the same operating conveniences and comforts that the automobile gives in transportation. Since the cost of operating these electric devices under a proper rate schedule represents little, if any, increase over actual costs of doing the same things by antiquated methods, the sales job should not be so difficult.

If we were selling just "kilowatt-hours" and only to standardized six-room Red Seal houses, the problem of rates would not be so difficult, but we may have houses of all sizes and with requirements all the way from lighting only to full and complete household service to deal with, so if we are going to "merchandise" our electric service successfully, we must have a convenient "price tag" that can be used whether the buyer has a six-room or a twelve-room house.

CLASSES OF HOUSEHOLD SERVICE

From the analysis above it appears that there are four more or less well-defined classes of household service, so we can regroup the uses in our model house according to value of service and cost of service about as follows:

Lighting service, including radio	37.4 kw.-hr. at 6	cents	$2.24
Appliance service	34.0 kw.-hr. at 6	cents	2.09
Refrigeration service, which includes laundry use	83.1 kw.-hr. at 5	cents	4.15
Cooking and heating service	325.0 kw.-hr. at 2.57	cents	8.37
Total	479.5 kw.-hr. at 3.52	cents	$16.09

Inasmuch as the above grouping of household use of electric service would hold good regardless of the size of the house, it would seem reasonable to use it

as a basis for making a rate applicable to any residential customer for all of his uses of electric energy.

The demand and also the consumption of energy for lighting are functions of the size of the house, so the simplest way for the electric company to secure the required protection and at the same time give the customer the fairest possible deal would be to make the first step on a basis of so many kilowatt-hours per active room per month. Floor area could be used, but it is harder to calculate and would not average any more accurately. The number of outlets could be used, but this would penalize the customer for installing convenience outlets.

The use of appliance service is also more or less a factor of the size of the house, so the next step could also be logically made on a basis of the number of rooms, using a lower rate and a smaller number of kilowatt-hours allowed per room. This would also tend to give further protection on the minimum.

The block which for convenience has been called "refrigeration service" bears little relation, as regards demand and kilowatt-hour consumption, to the size of the customer's house, so instead of using a room basis a fixed number of kilowatt-hours corresponding more or less to the average monthly consumption of electric refrigerators can be allowed at a different rate. In territories where automatic oil burners are used it is probable that a considerable part of their operation would come on this block. The electric refrigerator because of its high load factor should earn a rate lower than that of lighting. It should not come on the electric range rate, because the cost of service and the comparatively small kilowatt-hour consumption would provide no margin for service.

Once the electric company has received from the customer the amounts covered by the first three groups of service, it can afford to sell any further energy requirements at a kilowatt-hour rate approaching the cost of kilowatt-hour distribution. This group would normally cover requirements for cooking, heating, etc., and inasmuch as the kilowatt-hour consumption is high, the total amount received in this block would also be high, so any additional capital expense required to take care of this business would have ample coverage, even at a low kilowatt-hour rate.

An Inducement Rate Is Proposed

A rate based on these conditions might be expressed as follows:

Lighting service as sold hereunder will comprise 6 kw.-hr. per active room monthly, at the rate of 8 cents per kilowatt-hour, and this amount as calculated for the total number of active rooms contracted hereunder will constitute the minimum monthly bill under this rate.

Household appliance service will comprise the next 4 kw.-hr. per active room monthly, at the rate of 6 cents per kilowatt-hour.

Refrigeration service will comprise the next 80 kw.-hr. of monthly consumption at the rate of 5 cents per kilowatt-hour.

Heating and cooking service will comprise all monthly use in excess of the total indicated under the headings above and shall take the rate of 2.50 cents per kilowatt-hour.

It is interesting to apply this rate to the assumed needs of the ideal six-room house discussed above.

Lighting service.....six rooms × 6 kw.-hr. × 8 cents per kw.-hr.....	$2.88
Appliance service....six rooms × 4 kw.-hr. × 6 cents per kw.-hr.....	1.44
Refrigeration service.....80 kw.-hr. × 5 cents per kw.-hr.....	4.00
Heating and cooking service..339.5 kw.-hr. × 2.50 cents per kw.-hr.....	8.48
Total monthly 479.5 kw.-hr.....	$16.80

It will be noted that whereas the rates assumed in the preceding application to the "model six-room house." are higher on the lighting steps than those taken in the ELECTRICAL WORLD survey, the final answer in dollars per month is substantially the same.

Such a rate should be acceptable to regulatory bodies, as it could be made optional to the use of regular rates and "sold" to the customer along with the merchandising campaign. It is, of course, of little use to him if he does not use his "electrical servant" to the best advantage, but with the tremendous growth in the demand for electrical refrigeration, the writer believes that it can be used as the key to unlock the demand for a more general extension of the use of electricity for water heating and cooking, because under this rate form, every new use the customer finds for electricity shows up directly in a reduction in his cost of energy.

Advantages Claimed for Proposal

Summed up, a few of the advantages to the two principals, the electric service company and the consumer, are as follows:

The Consumer

1. *Simplicity.* Any one can easily figure the rate or check it at the end of the month.
2. *Fairness.* The man with the small house gets off the lighting step without having to use as much current as the owner of the mansion on the hill.
3. *Independence.* He can install any electrical equipment he desires so long as it is within the capacity of his fused circuits and can add such convenience outlets as he may desire without the feeling that some inspector will tell him he is robbing the company on connected load or outlets in excess of those registered in his rate.
4. *Economy.* His lighting and appliance service will cost him no more than before, if he has been making effective use of those servants and he has all the remaining service at energy rates below what he would have to pay on usual block rates.

The Electric Service Company

1. *Simplicity.* Only one standard house meter to read and to account for on the books. No possibility of error due to confusion of several meter readings in one house. Room basis easily determined with little chance for dispute with customer.
2. *Fairness.* The man with the big house pays the equivalent of a larger demand charge than the man with the small house, thereby assuring the company protection of investment.
3. *Earnings.* Each class of service pays proportional to cost and of value of service rendered. The minimum is automatically raised to a safer level and the encouragement of free use of service at low energy rates increases the total monthly revenue, which is the end desired.
4. *Public Relations.* The elimination of such inconsistencies as two meters with widely differing rates, inspections of connected load, etc., cost of lighting and appliance service in proportion to the size of the house and purchase of energy at rates comparable with those charged for sale of power should convince the average customer that the company is treating him fairly, and that is the essence of good customer relations.

There are other advantages and some disadvantages, of course, but the writer believes that some such rate form would be of tremendous help in the merchandising of electric service. The merchandising of the device to utilize the service naturally goes with this, and the other two parties to this discussion, the manufacturer and the dealer, will find their facilities taxed to care for the demand for electrical devices and material that will follow the universal adoption of some simple unified residential rate such as proposed herein.

Visibility in Street Lighting

New Test Object Described—Procedure in Use of Instrument Outlined, Together with Enumeration of Conditions to Be Observed in Study of Glare

BY PRESTON S. MILLAR AND S. MCK. GRAY
Electrical Testing Laboratories, New York City

IN A new device for studying visibility in street illumination, designed and constructed at the Electrical Testing Laboratories, an attempt has been made to retain the advantages of an earlier variable-contrast testing device* while adding means of ascertaining minimum perceptibility, not only by reflected light but also

INSTRUMENT IN POSITION FOR STREET-LIGHTING TESTS

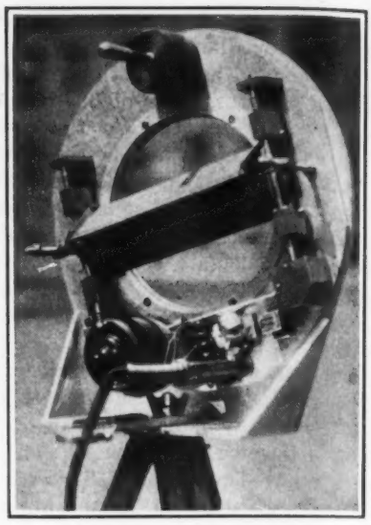
by silhouette against a lighted background in cases where the latter mode of vision prevails.

Essentially this new device presents to the observer an 8-in. aperture having a diametric bar of variable width at an adjustable inclination. In operation the bar is reduced to a minimum width, about ¼ in., and is adjusted to any desired angle. The width is then gradually increased by motor control directly operated by the observer stationed perhaps 150 ft. away until it attains to the stage of minimum perceptibility by him. After the setting is noted by an attendant, the bar is readjusted to the minimum width and some desired inclination for a repeated observation.

A variable width bar may be of any desired color, but for most purposes should be preferably of a reflection factor not appreciably different from that of the street surface. In the original bar a reflection factor of 14 per cent was adopted. The ring that forms the periphery of the aperture should preferably be of no higher reflection factor than the bar itself.

*ELECTRICAL WORLD, Oct. 20, 1910, page 941.

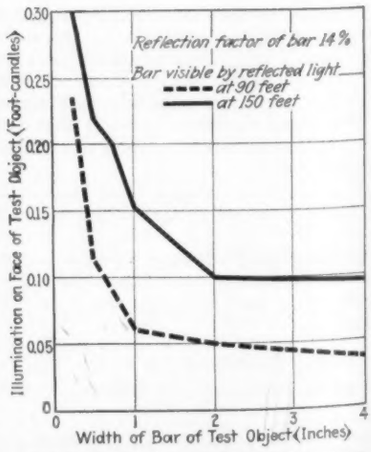
Observations as to threshold perceptibility are comparable for a given observer stationed at a given distance only when the bar is adjusted to a given inclination. Like the preceding device referred to, this instrument is subject to errors of astigmatic vision—also when viewed as a silhouette it is involved in complications due to variability of background brightness. In non-uniform lighting, the bar, if horizontal, may be observed against either a light or a dark background, whereas if vertical it may be observed against both a light and a dark background, subtended by various portions of the bar. If, therefore, an attempt were made to compare visibility with the bar horizontal and with the bar vertical, the results might be in error due to astigmatism of the observer and to variability of the brightness of the background.



CLOSE-UP OF DEVICE, SHOWING ARRANGEMENT OF CONTROLS ON REAR OF DISK

When the device is employed in the study of glare, repeated settings being made with the observer's eyes respectively protected from and exposed to glare, all settings with the bar at a given inclination must be assembled and segregated for comparison with settings under other conditions made with the bar at the same inclination. Like all threshold visibility test objects, this one is of low precision and is subject to variables of the observers such as ocular adaptation and ocular fatigue, which impose requirements for utmost care in its application.

Illuminated by reflected light, it has been found that the range of variation in bar width corresponds with a ratio of about 3 to 1 in illumination when observed from a distance of about 90 ft. and illuminated to an intensity of approximately 0.15 foot-candle. That is to say, an observer capable of seeing the bar at its minimum width with an illumination of 0.23 foot-candle would be able to see the bar at its maximum width with an illumination of about 0.04 foot-candle. At the distance indicated, the visual angles subtended by the bar when adjusted to a width of 1 in. would be 3.2 minutes for the width of the bar and 25.5 minutes for its length.



CALIBRATION CURVES OF VARIABLE TEST OBJECT

The simplest means of varying the range of this instrument is by vary-

ing the distance of observation. When concerned only with reflected light to the exclusion of vision by silhouette, the range may be extended by varying the reflection factor of the variable width bar. When so employed the aperture is backed with black velvet.

In advancing this brief description of a new test object, the authors desire to take the opportunity to state that this instrument and indeed all test objects employed in the determination of minimum perceptibility by test subjects are incapable of affording a full measure of the deleterious effects of glare in street lighting. These effects may be classified as:

1. Reduced visibility.

(a) Experienced by test subjects observing with attention concentrated; this effect has been measured.

(b) Further reduction experienced by users of a street under ordinary conditions of attention; this effect has not been measured.

2. Ocular discomfort.

3. Decreased attractiveness of a street lighted by glaring sources.

The device described above and all devices heretofore employed for threshold tests in the study of glare may be utilized only in the measurement of that part of glare which falls within 1-a of this classification.

Letters from Our Readers

The "Sore-Thumb" Top Rate

To the Editor of the ELECTRICAL WORLD:

I have followed with great interest a number of editorials you have published on residence rates and their forms, notably those of Nov. 9 and 26, 1926, and two later ones of March 12 and 26, 1927. Taken together and interpreted as a whole, their meaning is clear, but many of your readers may see one or more but not all of the articles.

May I suggest a word of reference to previous editorials or further advice in connection with the "sore-thumb" top rate of which you speak in your issue of March 26? I know of no "sore thumbs" among inducement rates which have been established by companies using this form of rate at present. Such a high rate is present, however, in other forms of price schedules now in use; but in such cases it may be said, generally, that not only the top rate but the entire residence schedule of prices should be changed and revised in order to design correctly an inducement form. Otherwise an unnecessary and heavy loss of revenue might occur.

The price of the top step and its width are of great importance in the inducement rate design. To paraphrase the latter part of your editorial of Nov. 9, a structure can be developed which will have the inducement feature but without the use of extreme assumptions in its building. It is necessary, however, properly to determine the height in price and width of the first step needed to collect fixed charges, partly at least in the first block, thereby retaining present incomes and rates of return. Having established this by means of a spread-curve analysis, the second step must be carefully determined because on its height in price and width in kilowatt-hours depend the increase in consumption desired. The price of the third step depends upon the value of the lowest-priced business one finds can be reached by correctly determining costs.

R. S. Hale and the writer demonstrated that changes in the price and width of the second step had, respectively, six times and three times the effect on consumption of similar changes in the first or top step. Again, if the top step of a broad-block or straight-line rate or of a demand rate having the effect of a broad-block rate be cut successively from time to time, it will result in a uniform rate, which is not the best economic form of rate to increase consumption and load factor continually. Up to a certain point such increase may be obtained by a periodic reduction of a uniform rate, but beyond this point one cannot go, and 1½-cent or 2-cent energy for water heating, etc., cannot be furnished as it could be by a properly designed rate.

Lowering the top step beyond a certain point again favors the small consumer and offers little inducement for the larger user to increase his load factor. The Maryland commission points this out in its decision in the Consolidated Gas, Electric Light & Power Company case of 1924. This was published in *Rate Research*.

We all know that the consumer who uses only a dollar a month or less of residence service may cost 15 cents or more per kilowatt-hour to serve. If we could get this price, which we can not, from the small user, our follow-up step could be relatively low. It is also generally agreed that unit investment costs and customer costs to serve the residence class are higher than for any other class, but in most cases the actual cost of service to the residence business is not known, or at least is not accurately determined.

The point I wish to emphasize is that in revising residence rates it is always dangerous to do so without an accurate knowledge of costs and rates of return. No other industry I know of would attempt to revise its selling prices without knowing its present costs and earnings on the particular article or service whose price it wished to revise. It is a matter of regret that many schedules of prices for residence service are not based on a knowledge of the cost of this service or the effect of increased load factor on costs and returns. Over-all system figures are not sufficient for this purpose. Some schedules of prices seem to have been devised to protect us against the minimum-bill customers and in the evolution of the business have only propagated more of them.

It is hoped that we shall not make further mistakes by blind reductions or uniform (single-price) rates. We should find our actual costs at varying load factors for serving the residence customers and properly design our schedules of prices to induce more usage and a larger return at decreasing unit costs to the consumer. A number of companies have followed this policy for some years, and the results are most gratifying to all concerned, as Samuel Insull pointed out last year. These results would convince the doubting Thomases that the cloud of a revised residence schedule, when properly based on cost and load factor, has a real and valuable "silver lining."

C. F. LACOMBE.

New York, N. Y.

John W. T. Walsh's "Photometry"

To the Editor of the ELECTRICAL WORLD:

In your issue of Feb. 12 (page 364) you have a notice on my book, "Photometry," but accidentally the name of F. G. H. Lewis appears as that of the author, whereas he was responsible only for the illustrations.

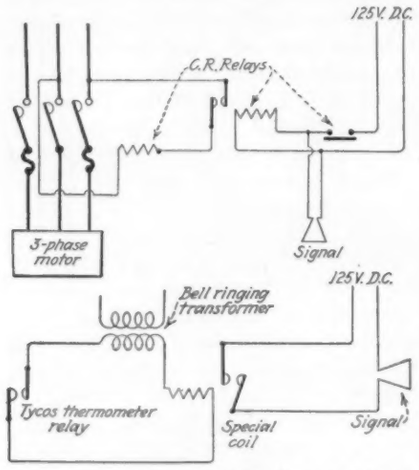
JOHN W. T. WALSH.

National Physical Laboratory,
Teddington, Middlesex, England.

Central Station and Industrial Practice

Signal Warns of Lubricating System Failures

TO PREVENT possible failure of the lubricating system for its electric generator and to avoid overheating the generator thrust bearing, the Power River Company of Vancouver, Canada, has installed a combination of General Electric control devices and warning signals. On failure of an oil pump, a spare pump is immediately started simultaneously with the sounding of an industrial alarm signal. Should the thrust bearing of the generator overheat, a similar system is automatically set in action.



SCHEMATIC WIRING DIAGRAMS OF SIGNAL EQUIPMENT USED TO WARN OF LUBRICATION FAILURES

The oil pump that is regularly used during the operation of the generator is driven through gearing from the generator shaft. An independent motor-driven oil pump is also provided with equipment for hand starting. Should the geared pump fail to operate, the motor-driven pump goes into service automatically, coupling with this action the sounding of the alarm. A pressure switch is installed in the discharge side of the geared oil pump. With this arrangement if the pressure of the geared pump drops, the pressure switch closes a magnetic switch and this starts the motor-driven pump. The second pump operates then until normal conditions are restored and pressure is again being delivered by the geared pump, whereupon the former is automatically relieved and shuts down. The industrial signal that sounds upon the closing of the pressure switch operates at 125 volts direct current.

The thrust bearing on the generator is equipped with a Tycos thermometer alarm control which operates a 125-volt direct-current industrial signal. Because the contacts of the thermometer control are suitable for handling low voltages only, it was necessary to devise a pressure wiring scheme as indicated in the accompanying illustration to permit functioning of the system on higher potentials.

Preparation of Electrical Equipment for Shipping

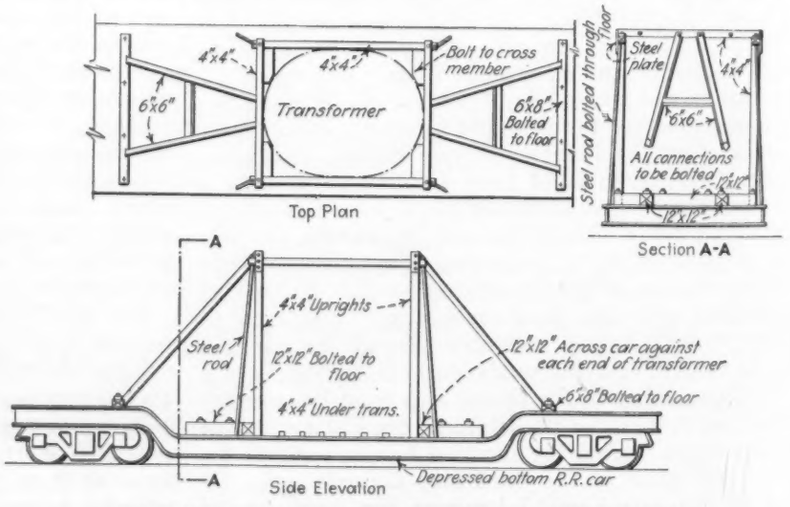
BY R. H. EWRY
Inside Plant Division
Commonwealth Edison Company, Chicago

PACKING, crating and loading of electrical apparatus for transportation deserve a great deal of study, and central stations are interested in this problem at both ends, as shippers and receivers. The sale of used equipment often includes the duty of shipment to the buyer, and the vital concern of the central station in the condition of new apparatus on receipt is obvious. Delays in construction, costly from the standpoint of both idle investment and lost business, are not to be tolerated as a result of faulty provisions for shipment of equipment.

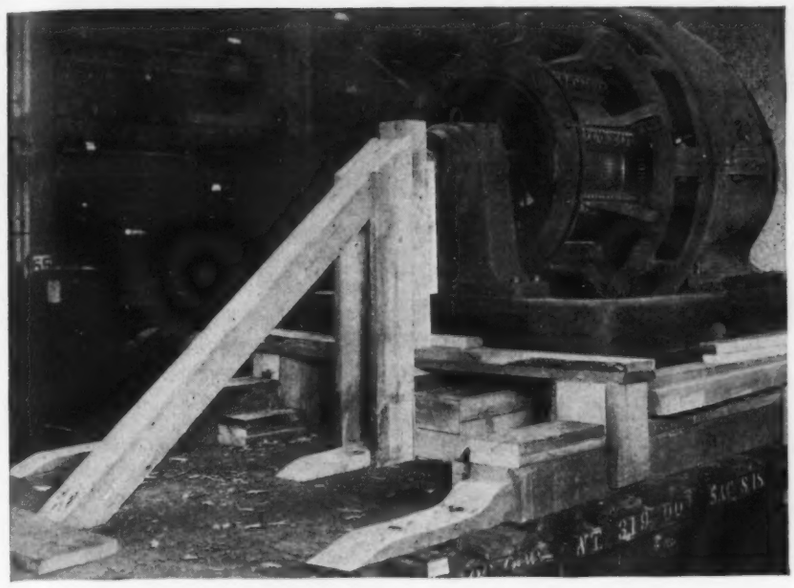
The fabrication of both fragile and rugged elements into the same apparatus assembly and the possibility of damage by moisture condensation through exposure to the weather are two definite factors to be taken into account in preparing a shipment for transportation. The first factor requires thoughtful attention to creating and bracing in or on the car and the second requires the same attention in the way of protection by means of moisture-resistant wrappings.

CLEARANCE IS IMPORTANT

In the shipment of large pieces, bridge and tunnel clearances enter the calculations. Head-room limits will often determine the manner of shipment as well as the route. An instance of this is shown in one of the accompanying illustrations, in which the coils, core and removable parts of a transformer were shipped in an oil-filled tank on one car and the case was laid side down on another. This is an exceptional case. For the shipment of transformers of 1,000 kva. and over the Commonwealth Edison



STANDARD BRACING OF TRANSFORMER ON RAILROAD CAR
Note that strain elements are rods and not cables. Cables will stretch and permit movement of the load



SHAFT-END BRACING ON ROTATING MACHINERY

Company has devised the standard method of bracing and blocking which is shown in the accompanying drawing.

Rotating machinery, regulators and other apparatus require the utmost care in shipping. Contact and bearings surfaces, coils not oil insulated and operating mechanisms are very likely to be damaged from condensation of moisture and must be thoroughly protected. Changes in climatic conditions encountered en route may do much damage if such protection is not supplied. When rotating machines are shipped assembled, effective measures must be taken to prevent end movement of the shaft by providing end bracings as illustrated.

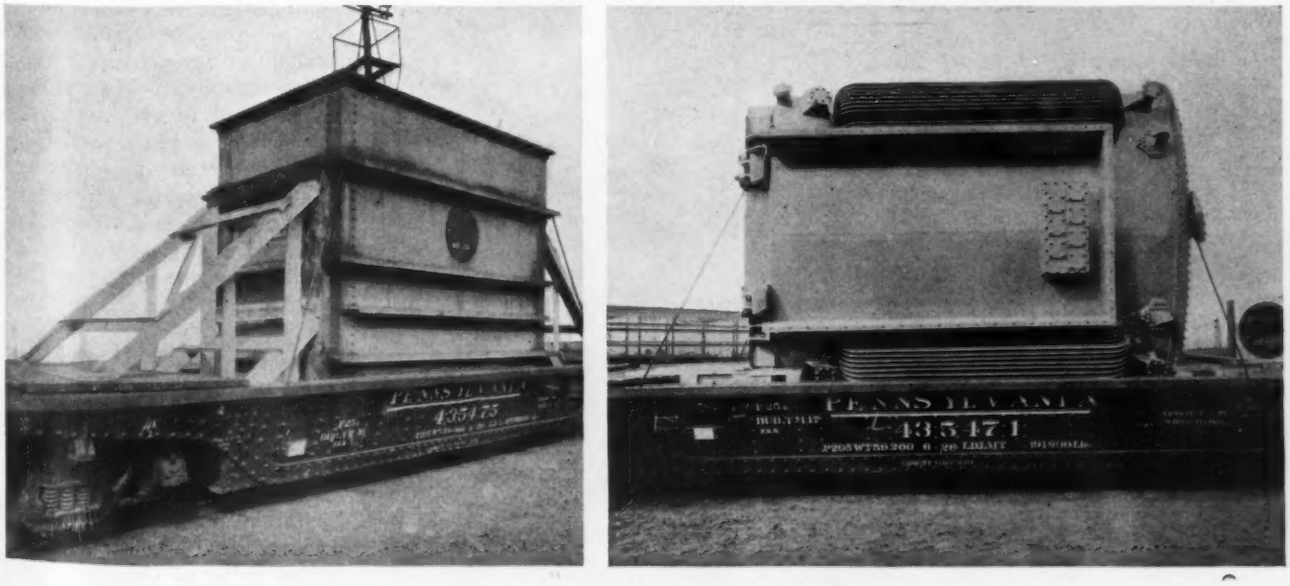
It not infrequently happens that a utility company disposes of line insulators removed from poles or towers during reconstruction. Pin-type insulators should be crated, individually or in compartments with others. Strain-type or multiple-unit insulators should be not only crated but held securely in suspension in the crate.

Chipped and cracked porcelain will result if units are packed loose in barrels or boxes. The only type of insulators that may be packed in barrels or boxes are small knobs or posts or plain guy strains that have no fluting, corrugations or edges likely to be damaged. Another reason for crating instead of shipping in closed containers is that freight handlers can actually see the fragile nature of the material and as a consequence are more likely to handle it carefully.

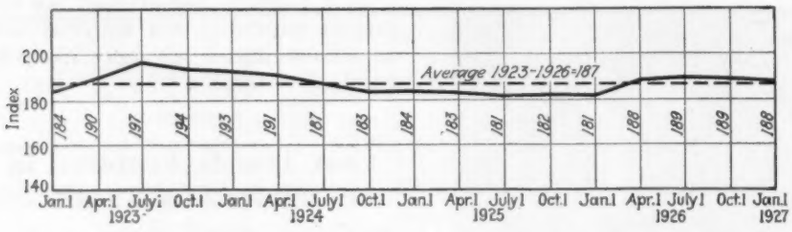
Cost Trends Featured in Worcester Case

ENGINEERING and construction cost data filed in commission cases constantly emphasize labor and material price advances since the outbreak of the World War in 1914, and the trends of these costs are of wide interest in connection with the preparation of estimates of new construction work, betterment projects, appraisals, etc. In the pending rate case of the Worcester (Mass.) Electric Light Company the chart reproduced herewith was recently filed as an exhibit by Frank E. Learned, head of the appraisal division and formerly superintendent of construction, Stone & Webster, Inc., Boston, to show the trend of power company construction and equipment costs during the past four years, using 1914 costs as base. The data show an average cost, based on investigations in fourteen power companies, of 87 per cent above pre-war figures for the period covered. The maximum price level, which is not shown on the chart, since 1914 was 123 per cent above pre-war, occurring in 1920.

In the discussion of the chart before the commission it was brought out that only four of the properties are under Stone & Webster management and that the efficiency of labor is now approximately equal to that prevailing in 1914 and about 20 per



TWO-CAR SHIPMENT OF LARGE TRANSFORMER



UTILITY PLANT COSTS SHOW MARKED STEADINESS IN PAST FOUR YEARS

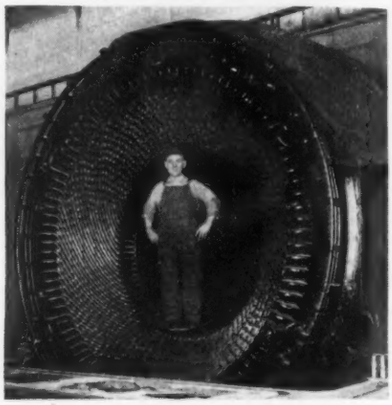
cent above 1920. It was also brought out that barring unforeseen major changes in world affairs, nothing is on the horizon at present to indicate any serious change during the next three or four years in the price level now being used. The Federal Reserve system is proving a more effective stabilizing factor than was expected, and labor is stoutly defending current scales of pay. Material prices of interest to engineers promise to remain steady for the present. It should be borne in mind, however, that improved methods of manufacture are influential in creating a downward pressure upon costs.

60,000-Kw. Turbo-Generator Connected Directly with Auto-Transformer

THE recent installation of a 60,000-kw. single-unit steam turbine generator at the Charles R. Huntley station of the Buffalo General Electric Company raised the station rating to 155,000 kw. The unit is rated at 66,667 kva., 1,500 r.p.m., and operates at 250 lb. gage, 250 deg. F. superheat, and 1 in. absolute back pressure.

A valve which is operated by means of a solenoid permits automatic adjustment of the load from a wattmeter relay, to hold a constant load on the turbine itself or on some other source of power in parallel with it. Operation of this feature in no way interferes with the action of the speed governor. The closed system of ventilation, using surface air coolers and external motor-driven blowers, is used for keeping the temperature of the generator unit within the commonly recognized safe operating limits.

Although the generator is rated at 12,000 volts to correspond with the other units in the plant, it is not connected to the 12,000-volt station bus.

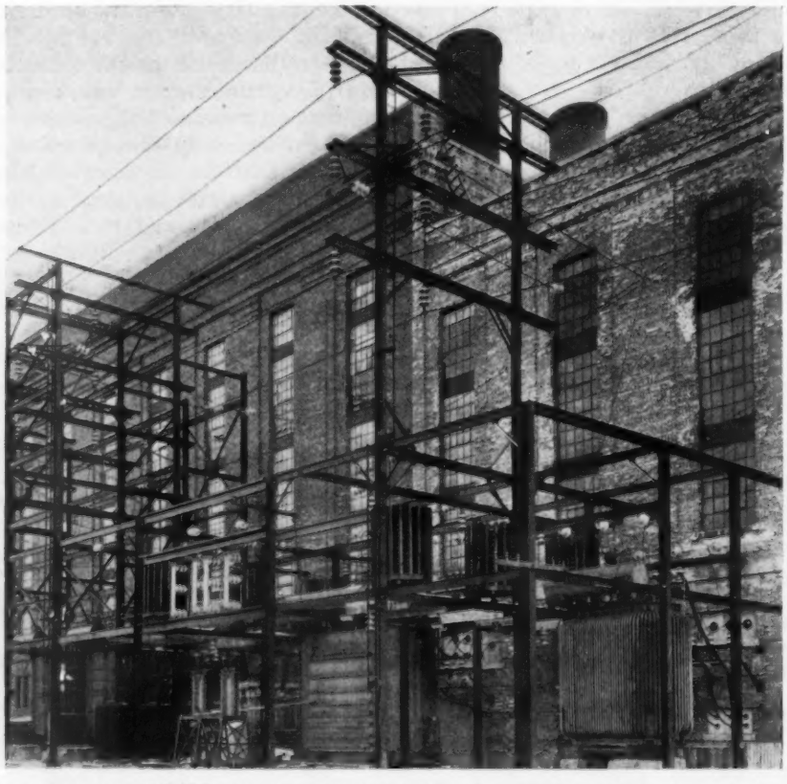


BECAUSE OF SHIPPING LIMITATIONS THIS 177-TON, 66,667-KVA. STATOR WAS STACKED AND WOUND AT DESTINATION

Instead it is permanently connected to an auto-transformer, which steps the voltage up to 22,000. Connection is then made directly to the 22,000-volt buses of an adjacent transformer station, which ties in with the Niagara system and serves as a distribution center for 22,000-volt power in Buffalo.

The auto-transformer is a three-phase, water-cooled unit, rated at 66,667 kva., 12,000/24,500 Y volts. An unusual feature of the design is that each winding is divided into two parallel circuits, which are switched separately. The transformer is laid out to give a considerably increased reactance with half the winding in the circuit. By means of suitable relaying one of the parallel circuits is opened before the other in case of trouble, resulting in a reduced interrupting duty for the oil circuit breaker. Under certain conditions it may not become necessary to open the second circuit, and the load can then be put back on the turbine with a minimum of operating delay.

The station now includes five steam turbine generators, three 20,000-kw. units, one 35,000-kw. unit and the new 60,000-kw. unit, all of the machines being of General Electric manufacture.



THREE-PHASE, 66,667-KVA. AUTO-TRANSFORMER (CENTER) DIRECTLY CONNECTED TO NEW 60,000-KW. TURBO-GENERATOR

The two banks of reactors are connected in the 22-kv. circuits from the auto-transformer.

Commercial Activities and Public Relations

Revenue Per $1,000 Gross Sales of Appliances

IN ORDER to ascertain the relation between the value of electrical merchandise sold and the annual revenue produced from energy used, Robert Montgomery, sales manager of the Louisville Gas & Electric Company, recently made an analysis of the principal electrical appliances sold by local dealers. The results of this study are shown in the accompanying table.

ANNUAL REVENUE PRODUCED PER $1,000 GROSS SALES OF VARIOUS APPLIANCES*

Six-lb. iron	$634.03
Toaster	255.06
Refrigerating machine	228.27
Electric range	181.00
Percolator	163.17
Twelve-in. fan	85.00
Telechron clock	70.48
Vacuum cleaner	25.40
Washing machine	9.62
Vibrator	2.91
Violet-ray	1.44

*The average net residential rate in Louisville is 7.289 cents per kilowatt-hour except for the electric range and refrigerator, which it was assumed would earn a rate of 3 cents under an optional room rate which is available.

Commenting on this analysis, Mr. Montgomery points out that the Louisville company does not merchandise appliances, but the relative cost and revenue-producing capacity of the various devices are of great importance to the central-station companies.

"Generally speaking," says Mr. Montgomery, "appliances that produce the greatest amount of revenue per kilowatt of demand and per dollar of initial cost have the greatest utility. This, perhaps, explains why the electric iron is the most popular of all household appliances.

"The inexpensive iron and toaster are almost invariably the first appliances purchased by the housewife, and as they prove to be entirely satisfactory and a great convenience, they pave the way for the washing machine and other more expensive devices."

40 Cents Per Ton for Electric Melting

BY B. K. HOWARD
Commercial Manager Texas Power & Light Company, Dallas, Tex.

ELECTRIC melting of steel used in the manufacture of rotary drilling equipment at the plant of the American Well & Prospecting Company, Corsicana, Tex., has been successful under severe conditions for several years. For this line of products steel castings varying in weight from 8 oz. to 1,234 lb. are required, the range of equipment including heavy traveling blocks, crown block sheaves, drum flanges, rotary tables, spiders, twin-cylinder steam engines, high-pressure mud pumps, etc. At first the company purchased the required castings, but when the demand for the product warranted the investment, an electric furnace was installed. The original furnace was succeeded in 1923 by a 0.5-ton Moore 'Lectromelt furnace equipped with a Pittsburgh transformer later designed to operate at 220 volts on the primary winding. In June, 1926, an agreement was made for the supply of power to this installation by the Texas Power & Light system, the furnace transformer being served at 220 volts, three phase.

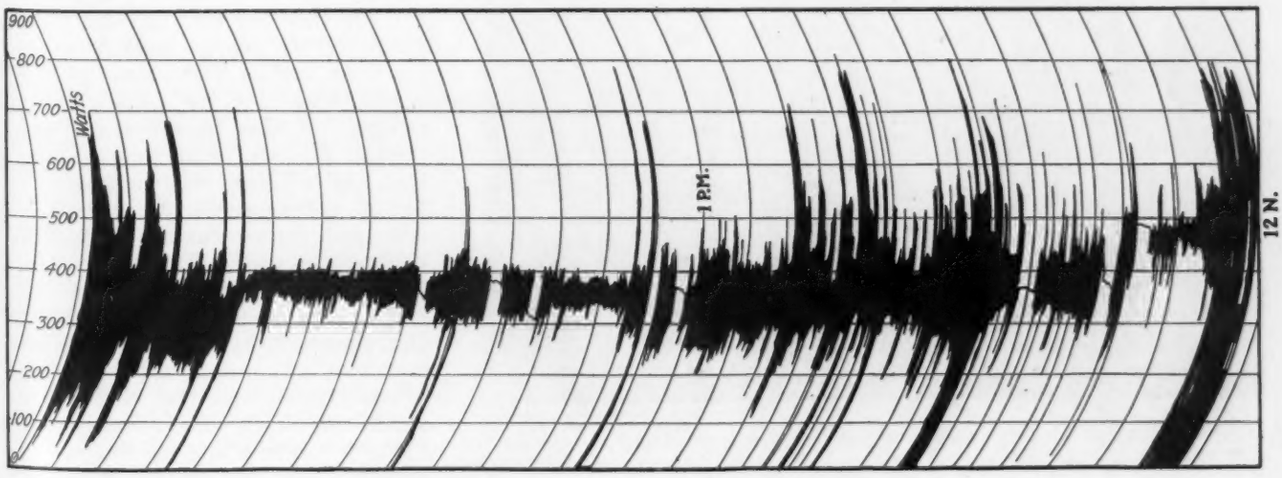
DATE 192

STEEL HEATS	1	2	3	4	5
TIME STOP					
TIME START					
NO. HRS.					
LAST READING					
PRESENT READING					
MAX. DEM.					
LBS. MELTED					
K.W. CONSUMED					

SHOP	REMARKS
LAST READING	
PRESENT READING	
K.W. CONSUMED	
MAX. DEM.	

FORM OF CARD USED IN KEEPING RECORDS

As a rule the furnace is operated four days a week, with an occasional fifth day. Since the American company's electric steel foundry and its iron foundry are under the same roof and are served by the same bridge crane, it is necessary to shut down the furnace on days when the cupolas are run. This condition, together with the fact that the furnace is operated only one shift per running



TYPICAL LOAD CURVE ON ½-TON ELECTRIC FURNACE
Multiplier = 800. Average demand reading was 390 kw.; kilowatt-hours used were 575.

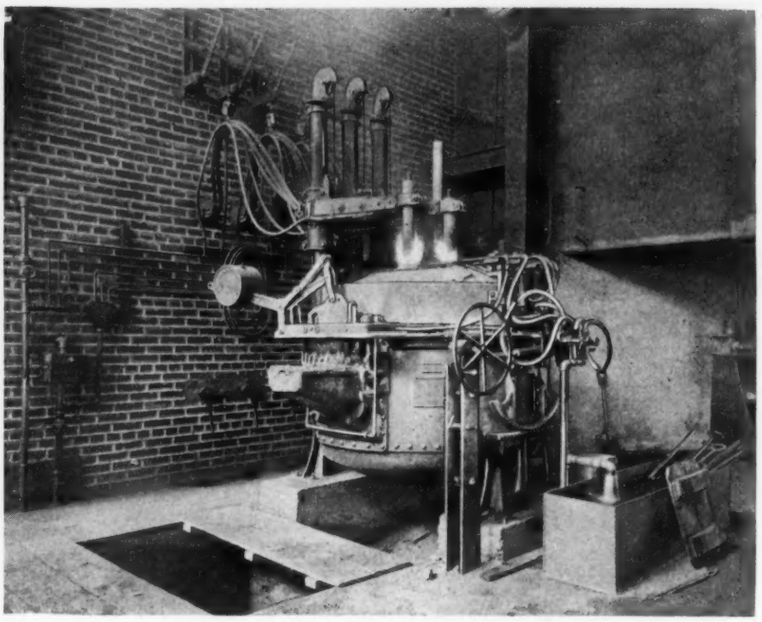
COST OF OPERATING ¼-TON FURNACE FOR MONTH OF DECEMBER, 1926

American Well & Prospecting Company

Annual Fixed Charges:	
Depreciation, 10 per cent (first cost plus installation expense $20,661.16)	$2,066.11
Interest on investment at 6 per cent	1,239.67
Allowance for mechanical repairs	250.00
Total annual fixed charges	$3,555.78
Monthly Furnace Operating Costs December, 1926	
Monthly fixed expense	$296.31
Steel scrap, 49.10, less foundry returns, 4.49 (gates, risers and bad castings) 44.61 tons at $15 per ton	669.15
Ferrosilicon, 544 lb. at $0.0595 per lb.	32.36
Ferromanganese, 1,088 lb. at $0.065 per lb.	70.72
Electrodes, 280 lb. at $0.2365 per lb.	66.22
Refractories, 62 cents per heat, 68 × $0.62	42.16
Power:	
34,272 kw.-hr. at 1 cent	342.72
Demand charge, 400 kw. off peak, restricted use, at 35 cents, in connection with other services at regular rates	140.00
Labor on Furnace:	
Melter, 200 hours at 60 cents	120.00
Total cost of 44.61 tons good castings	$1,779.64
Cost per ton of good castings	39.89

Average Analysis of Steel Castings:

Silicon	0.31
Sulphur	0.046
Phosphorus	0.042
Manganese	0.85
Carbon	0.27



ELECTRIC FURNACE WITH HEAT "MELTED DOWN"

day, accounts for the low monthly load factor of 20 per cent. Even under this condition the American company earns a rate so decisively competitive with the cost of energy produced by a former isolated generating unit that the company has ceased to operate the latter and is buying all the energy used at its factory. Since this furnace has been operated on central-station energy it has been possible to make one heat more per day than under the old operation.

The acid process is used and is quite satisfactory, due to the fact that a good grade of clean melting scrap is readily available. Most of the customary acid furnace practices are used, though the steel is made under a heavier slag than is customary in most foundries. It has been demonstrated that this practice of heavy slag produces better castings and adds life to the refractories. The refractories of a small furnace in a foundry are subjected to service strains, in that furnace operation is not continuous and the time taken to "warm up" a small furnace is less in proportion than with a larger furnace. In this particular case many small thin castings, such as hood latches, weighing only ½ lb., are poured from the same heat as the larger castings. This necessitates hotter metal than is ordinary practice and the heavy slag serves to protect the roof and side walls of the furnace.

The usual charge of cold scrap is 1,500 lb., though charges weighing 2,000 lb. have been used at times. A typical charge is as follows: 500 lb. spring steel, 500 lb. shoveling scrap and 500 lb. boiler-plate punchings. The steel turnings from the machine shop are used, a little being used on each heat on top of the regular charge to facilitate easy starting of the arc. Risers and gates from the castings are also used in the charge and are included with the shoveling scrap. This charge usually melts down in carbon very close to the specifications for the usual run of castings. Except for a few castings, the specification for the finished steel is: Carbon 0.25 to 0.30; silicon 0.25 to 0.30; manganese, 0.60 to 0.70. Sulphur and phosphorus are controlled by the scrap used, with 0.05 and 0.07 being the top limits respectively. All heats are tapped on eye examination of fractured test, and a sample from each heat is later analyzed.

The charge and the heat being under the direct supervision of the foundry foreman and the melter, no elaborate heat records are kept. A card form with space for condensed records for five heats in the furnace

Light Cure in Berlin Clinic Requires 10,000 Kw.

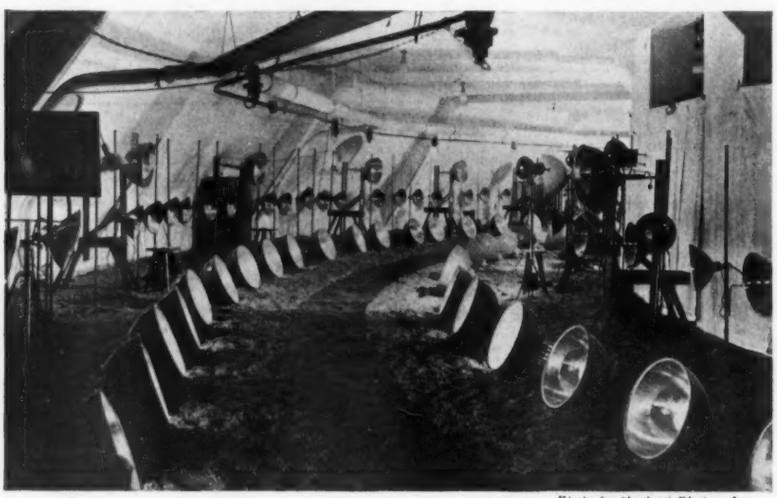


Photo by Herbert Photos, Inc.

A CLINIC for the electric treatment of various human complaints has been established in Berlin, known as the "Spa." In it 2,000 patients are treated daily. The light cure constitutes the most continuous large load, being furnished by training reflector-backed lamps, as shown, on a promenade along which patients stroll. The total load is reported to be about 10,000 kw.

Flexibility and Capacity Obtained in Office Wiring

A WIRING system that adapts itself to any arrangement of desks or furniture has been applied by Westinghouse building engineers in the new office building of the company at East Pittsburgh. Channels for the wiring have been provided beneath the floor by a series of grooves running the full length of the building. The general effect is that of a giant washboard, made up of many grooves and ridges. Lines may be drawn through any and all of these grooves and connections had at any spot by simply drilling a hole in the floor. Desks may be moved at will without loss of wires.

Similar simplification has been devised for wiring the desks themselves. A trough extending through each desk, lengthwise, carries hidden wires for regular telephone, interworks telephone and dictaphone. The trough eliminates the strip of metal molding used for shielding wires under the old method and an electrician can equip a desk with all the usual circuits in a very short time.

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and also space for a condensed record of power used in the machine shops is kept. One card, on the present operating schedule, is sufficient for a day's operation. These records are kept daily by the plant electrician and the furnace operator. Curve-drawing meters are used extensively. A sample of the card record form is shown on page 765.

The foundry foreman's record of castings made from any one heat is illuminating in that conditions demand that a "little of everything" be poured from a heat in order that production continue at full speed. His record discloses that from one 1,500-lb. heat there were eight different types of castings made, varying in weight from ½ lb. to 530 lb. each.

A jobbing steel foundry is enabled to concentrate its activities for at least one day's operation on a few jobs, whereas in this case limited facilities compel the steel foundry to "carry on" with the plant production as a whole. Purchasers of oil field equipment demand quick delivery, consequently the foundry operations are necessarily changed on very short notice. The electric furnace, with central-station energy always available, is readily adaptable to these changing conditions and enables the company to make quick deliveries on its products.

The cost of operating this furnace, including fixed charges, was $39.89 per ton of good castings for the month of December, 1926, the details being shown in the accompanying table.

Novel Arrangement for Floor-Lamp Display

BY C. E. MICHEL
Sales Manager Union Electric Light & Power Company, St. Louis, Mo.

IT IS always advisable to display decorative lamps illuminated, but it sometimes happens that lamp displays are moved from one part of the sales floor area to another. To provide sufficient outlets for lamp connections and to be sure that the outlets will be within reasonable distance no matter where the lamps are placed a very practical arrangement has been made in the new merchandise salesroom of the Union Electric Light & Power Company of St. Louis.

The store contains a number of movable platforms 42 in. square and about 10 in. high. They are wired with 24 outlets, six on a side. The entire number of lamps connected to the platform can be effectively shown in an area 6 ft. square. It has been found that group displays of lamps are much more attractive than arrangements in monotonous rows.

FLOOR-LAMP DISPLAY PLATFORM THAT CAN BE PLACED ANYWHERE WITH LAMPS TASTEFULLY GROUPED AROUND IT

Digest of Electrical Literature

Transmission, Substations and Distribution

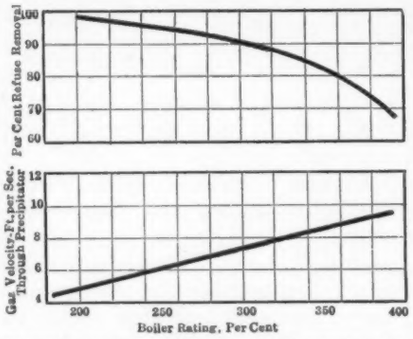
Boucherot's Constant-Current Networks and Their Relation to Electric Wave Filters.—A. C. BARTLETT.—The circuit arrangements devised by Boucherot to give a constant-current supply from a constant-voltage supply are briefly described in this paper, and it is then shown by the author that they may be regarded as simple examples of a more general property of all electric filters.—*Journal of Institution of Electrical Engineers (England)*, March, 1927.

Keeping Water Out of Small Transformers.—M. LAPINÉ.—During the last few years pole-type transformers of small capacities (up to 5 kva.) but relatively high voltage (up to 20 kv.) have found considerable application in the French rural districts as an outcome of extended electrification campaigns. Troubles were quickly encountered, due to water entering the tanks of these small outdoor transformers. The cover construction was not sufficiently weatherproof, and internal condensation on the under side of the cover introduced water. The first difficulty was overcome by an overhung cover edge, which protects the gasket, and the second trouble was relieved by either a calcium-chloride breather or a double cover. The author maintains that much damage is caused by the customer, who opens the cover to change voltage taps and then replaces it, but does not exercise as much care as the manufacturer, who provides a good gasket joint. It is therefore recommended to supply these small transformers with a ratio adjuster the handle of which is extended in a weatherproof joint through the cover. —*Revue Générale de l'Electricité*, Feb. 26, 1927.

Hydro-Electric Development and Steam Equipment

Hydro-Electric Station in Mühleberg (Switzerland).—As one of the stations of the Berne hydro-electric system, which supplies power for general and railway electrification in western Switzerland, the Mühleberg plant covers mainly the peak loads of the demand. Situated on the River Aar, a concrete dam provided a hydraulic head of 60 ft., which is utilized in a power house immediately at the foot of the dam. Six, and later eight, 8,100-hp. Francis turbines are installed, which drive 8,000-kva., 16,000-volt, three-phase generators. To facilitate an inspection or an exchange of the thrust bearing, the entire moving part of each generator set, including the turbine runner, can be lifted about one inch off the thrust plate by means of a set of hydraulic pistons. Depending upon which section of the Berne system is being tied in, the generators of this plant must be capable of producing either 40 or 50 cycles. The regulators of the turbines permit of a speed of either 133 or 166 r.p.m. For operation with 50 cycles a number of stator coils and two of the exciter poles are disconnected. Two 5,000-kva. motor-generators change a part of the station supply into 16⅔-cycle, single-phase railway power, which is transmitted at 15 kv. The bulk of the output leaves the station over a 45-kv. and a 150-kv., three-phase line. Four 8,000-kva., three-phase indoor transformers feed the former, while two banks of 20,000 kva. each, consisting of American single-phase transformers, step up to 150 kv. — *Bulletin de l'Association Suisse des Electriciens*, January, 1927.

Electrical Smoke Precipitation. — Refuse from the combustion of pulverized coal which passes from the boiler outlet with the gases is in the form of a powder finer than the coal fed to the burner. The principle of electric precipitation requires the flue gas to pass between steps of positive and negative electrodes. The positive electrodes are grounded to the flue or building steel; the negative electrodes are thoroughly insulated from the same and energized at 35 kv. to 50 kv. unidirectional current, so that a corona discharge from the negative to positive electrodes is formed, thus charging the suspending particles negatively and causing them to be attracted to the positive or grounded electrodes. This paper describes several improvements that have been made in the design of the precipitators since the time of their initial adoption. — *Electrical News (Canada)*, March, 1927.



RESULTS OF TESTS MADE ON A PRECIPITATOR, TRENTON CHANNEL PLANT, DETROIT EDISON COMPANY

Generation, Control, Switching and Protection

Carrier-Current Selector Supervisory Equipment.—C. E. STEWART and C. F. WHITNEY.—This paper describes a supervisory system which centralizes the control and indication of all power used in operating a modern interurban railroad. Supervision is accomplished over a single circuit consisting of one insulated wire with ground return. A single-frequency carrier current is used for transmitting all signals over circuits connecting all stations. Considerable attention has been given to making the equipment simple in design, rugged in construction, easy to install and convenient to maintain. — *Paper presented at the regional meeting, A.I.E.E., Kansas City*, March 17, 1927.

Units, Measurements and Instruments

Linkage-Current Diagram for Representing Magneto Operation. — F. B. SILSBEE and D. W. RANDOLPH.—This paper presents a diagram in which the electromagnetic cycle of operation which leads to the production of a spark by a magneto or induction coil can be represented in detail. Inasmuch as areas on the diagram are used to correspond to the energy changes involved, it is in a way analogous to the "pressure-volume" or the "temperature entropy" diagram used in thermodynamic studies. Methods are given for plotting the diagram from data of various kinds, and sample diagrams are shown. In the appendix is given a detailed mathematical discussion of the oscillations which can occur in the case when a circuit containing inductance, capacitance and resistance is coupled to another containing inductance and resistance only. This combination is similar to that existing when any current in the coil or any current flowing in the spark or in the carbon deposit on a fouled spark plug reacts on the current in the magneto winding.—*Scientific Papers of Bureau of Standards, No.* 543, Dec. 31, 1926.

Measurement of Earthing Resistances.—This article enumerates some fundamental requirements of an earth-testing device, and discussion is included on the disadvantages of the usual methods employed. Considerable space is devoted to the description of a new device and its method of application. — *Electrician (England)*, March 18, 1927.

Illumination

Control of Illumination from Windows.—H. H. HIGBIE.—Data are given in this paper from numerous surveys of natural lighting in a variety of full-sized rooms, with and without means for controlling the illumination from the windows, and these data are arranged in such a manner as to permit drawing conclusions, at least tentatively, concerning the relative effects of the various means of control upon quantity and quality of the illumination. The means referred to include shades covering top of window, shades covering bottom of window and Venetian blinds covering the whole of the window. With the blinds tests are given to show the effect of changing the slope of the slabs upon the indirect and direct components as well as upon the total illumination. Among other tentative conclusions reached by an examination of this data the author expresses his theory that natural illumination in interiors by means of roller shades which cover the upper part of the window is the least desirable method. It is better to use shades which cover the lower portion of the window, the roller being mounted at the meeting rail of the upper and lower sash, or at the window sill, or adjustable in height. In this connection it is

considered better practice to use Venetian blinds, which operate to redistribute the light rather than to absorb it.—*Transactions of Illuminating Engineering Society*, March, 1927.

Motors and Control

Excitation of Reactance-Controlled Rotary Converters.—R. G. JAKEMAN.—This article deals with the calculation of the ampere-turns required for exciting a rotary converter as compared with the same calculations for a direct-current generator. It serves as an introducton to the discussion of the problem of rotary converters. Some attention is devoted to a discussion of the open-circuit characteristic of the rotary converters with vector diagrams and mathematical treatment of the subject included. Load characteristics when running inverted are enumerated for this type of equipment. — *World Power (England)*, March, 1927.

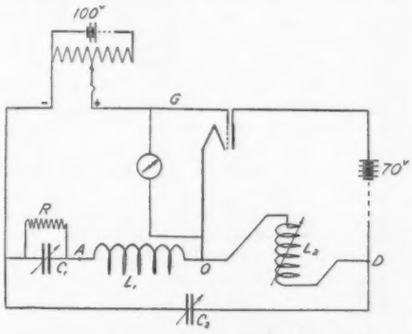
Influence of Voltage and Frequency Variations on Rotaries. — SCHINDLER-LENTZ.—Experience with rotary converters has indicated that these machines are very sensitive to even slight variations of voltage on the three-phase side, causing a drop-out and service interruptions. An extensive investigation of this problem which was carried out on the system of the Berlin municipal supply is described in the paper. A 5,000-kva. generator and several 1,000-kva. rotaries were available for these tests. More than 100 oscillographic records were made during the tests, which supplied data for theoretical investigations. It seems that rotaries seldom actually fall out of step owing to voltage or frequency variations. The frequent and undesired opening of three-phase or direct-current breakers in such cases is not necessary to protect the machines, which will stand readily very high overloads lasting for only a few cycles. Only in case of very abrupt voltage drops will the rotaries actually fall out of step. Connections are given to prevent a drop-out even under the most unfavorable conditions, without endangering the machines. — *Electrotechnische Zeitschrift*, Feb. 3 and 10, 1927.

Electrophysics, Electrochemistry and Batteries

Mechanism of the Absorption of Water by Rubber.—H. H. LOWRY and G. T. KOHMAN.—This paper reports the results of an investigation of the factors influencing the absorption of water by rubber, together with a theory of the mechanism of absorption based on the results obtained from experimental work. The absorption of water from both the gaseous and the liquid phase was studied and found to be the same in both cases, provided the constituents other than water present in the phases do not enter the rubber or react within. Washing rubber by a process which is described in the paper was found to reduce the amount of water chargeable to constituents in the rubber, and consequently the amount of water absorbed by the rubber. The rate of water absorption was found to increase with temperature, but in most cases the amount absorbed was not greatly dependent upon the temperature. Hydrostatic pressure of 10,000 lb. per square inch was found to reduce the rate of water absorption but to have very little effect upon the amount absorbed at equilibrium. It was determined that the amount of water absorbed by rubber compound is increased by a slow aging process which takes place even though the rubber compounds are immersed in solution if air is not excluded. This aging takes place to the greatest extent on the surface. Rubber compounds of approximately 7 per cent combined sulphur undergo this aging most. From these and other facts brought out in the tests performed it has been concluded by the authors that the most important factor determining the amount of water absorbed by a given sample of rubber is the vapor pressure of water with which it is in equilibrium. The absorption of water by rubber appear to consist of two processes—the formation of a true solution of water in rubber and the formation of solutions internal to the rubber of water-soluble constituents of the rubber which can be removed by washing. —*Bell Telephone Laboratories Reprint B-228*, February, 1927.

Telegraphy, Telephony, Radio and Signals

Intermittent Valve Oscillator.—L. S. TAYLOR.—As explained by the author an intermittent valve oscillator can be described as an oscillating circuit maintained by thermionic valves which oscillate only during certain definite intervals of time. The periods of normal oscillations when interspersed by intervals of silence will be termed "zules." The effect may be procured



OSCILLATING CIRCUIT WITH VARIABLE GRID-BIASING POTENTIAL

by the insertion of proper high resistance and capacitance into the grid circuit of an oscillator. Various studies of the phenomena have been previously reported in papers by other authors. The circuit used in this study is of a modified Hartley type. A high resistance of very constant value and a variable mica condenser in parallel were included in the circuit as shown in the accompanying figure. For purposes of clearness the author considers the whole as a network of three circuits, each pair having a branch in common. He continues with a complete description of the experimental work done and a detailed analysis of the results obtained.—*Journal of Franklin Institute*, March, 1927.

Heat Applications and Material Handling

Comparative Tests on Chrome-Nickel Wires.—W. ROHN.—A new method is explained for the comparative testing of alloy wires such as are used for units in electric heating devices. According to this method the suitability of such alloy wires is indicated directly by the amount of oxidization which takes place at repeated heatings of the conductor. A very large number of tests were made with German, English and American alloys, consisting of chromium, nickel, iron and molybdenum. All wires were 0.02 in. in diameter and 14 ft. long and were heated to 900, 1,000 and 1,250 deg. C. The data obtained are compiled in 34 curve sheets. — *Elektrotechnische Zeitschrift*, Feb. 24 and March 10, 1927.

Traction

More Life, Less Cost.—D. J. BOLTON.—According to the author the cost of a given quantity of illumination is made up of two main items—the cost of lamp renewals and the cost of energy. Usually the latter represents from two to ten times the former, so that at first sight the increased efficiency would appear to be well worth paying for even at the cost of a considerably higher lamp price. Unfortunately, the only way of getting a better efficiency with a given type of lamp is, according to the writer of this paper, by running it at a higher temperature with a correspondingly shorter life. As a small degree of overrunning produces only about 2 per cent increased efficiency, while it results in about 14 per cent shorter life, it is evident that there are very narrow limits to the amount of overrunning which becomes economically desirable. The author proceeds to discuss the matter in more detail, basing his statements on European practice almost exclusively. — *Electrician (England)*, March 11, 1927.

Miscellaneous

Problems Arising from the Expansion and Interconnection of Power Systems.—F. C. HANKER.—The questions which must be satisfactorily answered to obtain the fullest advantages of interconnection are stated by the author. Conclusions in regard to the successful operation of a system under steady load conditions and during transient conditions resulting from switching and system faults are reviewed. The discussion relates the advantages of interconnection and discusses the chief engineering problems involved. Mention is made of important contributions, including the method of general circuit constants, the development of the power-circle diagram and phase-sequence method of handling unbalanced circuits, particularly applicable for the study of faults. While analytical work and set tests on a few systems have done much toward rationalizing the design of component parts and the layout of the system as a whole, the actual operating limit, as imposed by transient disturbances, must, according to the author, be obtained from operating experience.—*Electric Journal*, March, 1927.

New Books

Elements of Heat-Power Engineering

By William N. Barnard, Frank O. Ellenwood and Clarence F. Hirshfeld. New York: John Wiley & Sons, Inc. 493 pages, illustrated.

This new edition of the parts of a previous book that related primarily to thermodynamics and the elementary principles of prime movers incorporates some distinctly new methods of treatment that were evolved while teaching the subject since the earlier editions were issued. An important addition to the original text is the development for engines and plants using vapors of ideal cycles involving reheating and regeneration with the same number of reheating and bleeding points that are employed in the actual plant. The book has been arranged in such fashion that many of the sections devoted to the more advanced discussions may be omitted, when desired, without destroying the continuity of the treatment.

Electrical Machine Design

By Alexander Gray. New York: McGraw-Hill Book Company, Inc. 523 pages, illustrated.

The principal changes which have been made in this second edition have been to bring the text and design illustrations up to date. A great many of the machine specifications and examples have been altered so as to be more in accord with the latest advances in present-day practice. In this revision by Prof. P. M. Lincoln no attempt has been made to change the late Professor Gray's original concept of a suitable presentation of fundamental principles and methods of analysis.

Electric Trains

By R. E. Dickinson. London: Edward Arnold & Company. New York: Longmans, Green & Company. 292 pages, 138 illustrations. Price, $6.

Of the few books on the subject of electric traction, some have been allowed to become out of date while others embody a mass of statistics and other data and cover a very wide range. Still others are very advanced, and their treatment, while essential to the specialist, demands a familiarity with mathematics beyond the usual scope of the student or the railway engineer. This book, primarily addressed to the railway engineer, is a welcome addition to the books available. It deals with the fundamental principles of electric traction, with the apparatus and devices in use and with convenient methods of making calculations required in practical working. The mathematical portions have been written as simply as possible for the benefit of the student, and, where possible, methods have been worked out from first principles rather than from formulas.

The chapter devoted to current collection is very complete, covering the various overhead conducting systems, kinds, wear, tensioning and staggering of wires, conductor-rail systems and current-collecting apparatus. The discussion on brakes covers virtually all methods in use, and the subject thus receives detailed consideration. The only mention of automatic train control is in this chapter on brakes, and there it is treated only briefly. It is to be regretted that the subject does not have fuller discussion. Direct-current, single-phase, three-phase and split-phase systems are elaborately described, as are the various apparatus control systems.

Accounting Procedure for Public Utilities

By Warren G. Bailey and D. E. Knowles. Chicago: A. W. Shaw Company. 471 pages, illustrated.

In discussing the many phases of public utility accounting the authors of this book have recognized the importance of the accountant's position in relation to the economical operation and management of utility companies. It is shown that while the compilation and recording of purely accounting and financial data is the logical function of the accountant, his duties extend beyond these limitations. Customers, stockholders, employees and the public all present special problems to the accountant which can often be solved by better accounting methods and more useful reports.

In this book are discussed the accounting records that have been found necessary, together with explanations of the manner in which the records are kept and the purposes for which the information is used. For the most part the procedures presented are a composite of those used by various companies rather than the specific practices of individual companies. The subject matter embraces all phases of utility accounting, taking up among other things uniform classification of accounts, operating expense, timekeeping and payroll methods, storeroom, merchandise, customer and construction accounting, auditing and budget procedure and the interpretation of financial and operating statements. For the utility accountant or executive this book will prove a useful reference work.

Patents

By Roger Sherman Hoar. New York: Ronald Press Company. 232 pages. Price, $4.50.

A practical volume which removes from the subject of patents all the maze of legal phraseology and treats of patent tactics in simple language. The subtitle, "What a Business Executive Should Know About Patents," well describes the function of the book. The whole subject is divorced from technical terms, the need of the business executive for a knowledge of patent tactics is clearly outlined, and the explanations are illustrated with concrete examples. The author outlines a clear-cut policy that protects a company from loss of patents and outmaneuvering by a competitor. A strictly business viewpoint is taken, and many false notions connected with patents are corrected. In general the book gives a thorough understanding of patent tactics and will enable the executive to decide more accurately what legal procedure to follow.

Arc Welding

Cleveland: The Lincoln Electric Company. 160 pages, illustrated.

This treatise on the new age in iron and steel, as the subject matter of the book is appropriately called, is a very comprehensive treatment of arc welding. The book shows, with many illustrations, what is being done and what can be done by the use of arc welding in manufacturing and also shows how to redesign machinery so that it can be manufactured by the arc-welding process. The procedure for redesigning machine parts is treated at length, and there are complete data on the strength and cost of various types of welded construction. Many diagrams and charts show welding speeds and costs. The book makes the claim that 90 per cent of the iron castings now used could be replaced by arc-welded steel at a decided saving. A chapter is devoted to automatic arc welding, and there are numerous photographs.

A Small Stockholder

By John T. Broderick. Schenectady, N. Y.: Robson & Adee. 127 pages.

This book presents in an informal and engaging manner the relationship existing between corporation stockholders and management. The opening chapters consist of a review of the report of the American Telephone & Telegraph Company for the year 1925 and of the United States Steel Corporation for the same period, the analysis being made from the point of view of the stockholder. In the review of the Steel Corporation considerable attention is given to such subjects as cash, surplus and depreciation—all of vital interest to investors.

In Chapter VIII Mr. Broderick gives an estimate of the number of stockholders in the country—seven million. That figure represents the total number of individual stockholders in enterprises classed as basic industries and in utility and railroad companies. By the "Third Estate," the title of the chapter, the author means stockholders, the other two estates of industry being management and labor. Chapter IX outlines a tentative constitution and set of rules for a national association through which stockholders will be supplied with more information about their properties than has been available in the past and will receive "an audible voice and influence in management."

Books Received

China: A Commercial and Industrial Handbook. By Julian Arnold. Washington: Government Printing Office. 818 pages, illustrated.

Guiding Principles of Public Service Regulation. By Henry C. Spurr. Rochester, N. Y.: Public Utilities Reports, Inc. 919 pages.

Report of Public Utilities Commission, 1926. Hartford, Conn.: Published by the State. 902 pages.

News of the Industry

Upper Connecticut Project

New England Power Plans Hydro Development of 200,000 Hp. on Vermont-New Hampshire Stretch

THROUGH the purchase of timberlands and water rights from interests identified with Stone & Webster, Inc., and Hornblower & Weeks, Boston, the New England Power Company group has lately come into possession of power-developing privileges on the upper Connecticut River between St. Johnsbury, Vt., and Littleton, N. H., which center in the stretch of the river known as Fifteen-Mile Falls, and which engineering investigation shows will yield 150,000 kw. in primary power and an output of 400,000,000 kw.-hr. per year. In this section of the river there is a drop of 330 ft. and two developments will be required to complete the project.

To a representative of the ELECTRICAL WORLD President H. I. Harriman of the New England Power Company said this week that 4,000,000,000 cu.ft. of storage facilities are already developed in this region and that this development is to be doubled when the project is carried through to completion. It is not known when work will be started at Fifteen-Mile Falls, but the developments of the company on the Deerfield River are approaching completion and the New England Power group is now turning to the upper Connecticut as a means of further expansion. Present indications are that this project will not be undertaken this year. Surveys indicate that this development will be one of relatively low cost per kilowatt or primary power output compared with many other New England hydro-electric enterprises.

Promoter Links the Ontario Hydro with "Power Trust"

Something of a sensation was created at Ottawa on April 5 when Harry Sifton, one of the promoters of the Georgian Bay Canal project, which, as already reported, is arousing embittered controversy because of its relation to hydro-electric development on the Ottawa River, said before the parliamentary committee now considering the matter:

"The opposition to this scheme comes from the power companies and the Ontario Hydro-Electric Power Commission, which in this instance stands hand in glove with the power trust. I say that the abdication by the Federal Parliament of its rights would throw the river into the hands of the power trust of America, which would immediately duplicate the situation on the Gatineau River at half a dozen points on the Ottawa River. Not only on the Ottawa, but on the St. Lawrence too. There is in Canada a very large and very powerful association of power, pulp and paper and banking interests. They are already becoming too powerful in the Province of Quebec. They have made a working alliance with the Hydro-Electric Commission of Ontario."

Mr. Sifton submitted that the arrangement between the "power trust," the Ontario Hydro-Electric Power Commission and the National Hydro-Electric Company, which holds the lease to develop Carillon power on the Ottawa River, was an arrangement hostile to federal rights of navigation and should not be approved.

New Muscle Shoals Idea Falls Flat

No One Enthusiastic for Another Commission of Any Kind—Wilson Dam Pays Its Way on Low Output—Chief of Engineers to Study Cove Creek Project

BY PAUL WOOTON
Washington Correspondent ELECTRICAL WORLD

THE recent suggestion that a commission of eminent men, well intrenched in the confidence of the public, be asked to make a businesslike recommendation for the disposition of the government's Muscle Shoals properties seems to have aroused no enthusiasm in any quarter. There is evidence that the public has been thoroughly disgusted by the inability of Congress to make a very simple business decision. There have been so many reports on Muscle Shoals and so many studies of the very well-understood problems involved that the appointment of even the kind of commission now proposed would, some think, provoke criticism.

There also is a growing feeling that, if left alone for a year or so more, the part of the problem at Muscle Shoals connected with the manufacture of nitrogen will solve itself. Consumers of fertilizers have not been convinced as yet, but nitrogen specialists long since have recognized that no low-cost fertilizer ever will be made at Muscle Shoals. Experts in the Department of Agriculture whose whole interest is to obtain cheaper and better fertilizers long since pointed out that there are many places where atmospheric nitrogen can be fixed to greater advantage than at Muscle Shoals. Ordnance officials began to give indications two years ago that they are not relying on Muscle Shoals as a source of nitrogen for munitions manufacture.

As a consequence disinterested public officials recognize that Muscle Shoals is a power project and nothing else. As a power project it already is earning its way. Just as soon as the real facts become known to the users of fertilizer it will be possible to drop from consideration the question of fertilizer manufacture. Since electrical energy is a commodity of known value, it seems that it then would be comparatively easy to lease the property to the highest bidder.

During March the Alabama Power Company took only 20,000,000 kw.-hr. of power from the Wilson Dam. This rapid drop from the 50,000,000-kw.-hr. level was due to abundant rains and the increase of storage at other hydro-electric plants in the Southeast. During the past year the government's Muscle Shoals plant has been more than self-sustaining, even when not operating at capacity. More than $800,000 has been turned in.

The $200,000 allocated for Cove Creek is to be expended by the Chief of Engineers for the determination of foundation conditions at Cove Creek and for a special study of the principal storage sites on the Tennessee River from its mouth to Knoxville. An estimate will be made of the cost of the Cove Creek project and a study made of the economic features of the development. This work is being undertaken at the request of the military affairs committee of the House of Representatives for the purpose of determining the cost of the development and to get more definite information as to the relationship of the project to Muscle Shoals and to other upper Tennessee water-power sites.

Chicago Defeats Home Rule

By Narrow Margin City Fails to Give the Amendment the Required Majority of Total Vote Polled

ONLY 15,000 votes stood in the way of adoption of a home rule amendment voted on in Chicago last Tuesday on the petition of 260,000 citizens. This amendment would have taken control of all local utilities from the hands of the Illinois Commerce Commission and vested it either directly in the Chicago City Council or in a local commission created by the Council. It was drawn in accordance with the state public utilities act and would have taken effect almost immediately.

The amendment had the support of the *Tribune*, which declared that "Chicago is now completely at the mercy of corrupt politics as Springfield." It polled 481,708 votes. To become effective it required a majority of the total number of votes cast in the mayoralty election—993,617. The proposed plan would have given Chicago a greater degree of control over privately owned utility companies than is now possessed by any first-class city.

In the Legislative Mill

Exit the St. Lawrence for 1927—Tennessee Investigators Want No Public Water-Power Development—Perpetual Franchise Fails in Missouri—Some Capitals Still Busy

PROMPT veto by Governor Smith of the bill to create a temporary commission to study and investigate the water-power situation in New York State was so entirely in accordance with expectation that it did not create a ripple of interest in utility circles in that state. In a memorandum accompanying the veto the Governor said: "For reasons repeatedly stated this bill is disapproved, as it would waste the public funds and accomplish no useful purpose." The veto leaves the Miller act providing for private development nominally in force but for the present at least a dead letter.

Advocating that the State of Tennessee exercise its rights of sovereignty over water-power developments in the state while permitting private capital to operate those developments, and expressing its belief that the United States government should exercise its rights only to promote and maintain navigation, the water-power investigating committee of the Tennessee Legislature has made its official report. The committee is strongly against development by the state, saying that within ten or fifteen years between $150,000,000 and $200,000,000 will be required to develop the state's resources, a project too large for the state to assume. The committee found no expressed intention of the federal government to exclude the states in the development of water power and believes that with proper co-operation between state and national authorities there need be none. The committee recommended that the Governors of Tennessee, Virginia, North Carolina, South Carolina, Georgia, Alabama, Mississippi and Kentucky hold a conference on the development of the Tennessee.

The Maryland General Assembly has passed a bill under which the Maryland Public Service Commission is empowered to fix minimum as well as maximum rates charged by public utilities. This and several other bills which have been passed were introduced for the purpose of strengthening the Public Service Commission law. One of the measures gives the commission power to hold joint hearings with commissions of other states. Another authorizes the appointment of a general counsel to the commission.

Public utility interests of Missouri were disappointed when the Missouri General Assembly adjourned on April 4 without passing the so-called perpetual franchise bill that was pending on the Senate calendar when the session ended. The measure had been reported out favorably by the Senate judiciary committee after being amended to exclude St. Louis and Kansas City utilities. The bill, if passed, would have made the public utility companies of the state more valuable because they would have operated under indeterminate instead of 20-year franchises, many of which are about to expire. There was a provision that utilities could be purchased by municipalities at any time, and if the buyer and seller could not agree on a fair price the Missouri Public Service Commission would fix the amount to be paid.

Besides the bill already referred to in this column to set up a regulatory commission for public utilities in Florida, a bill sponsored by the Florida Association of Municipal Electricians and the Florida Association of Electragists will be introduced at the approaching legislative session to set up uniform standards of electrical construction, using the National Electrical Code as a guide. It provides for a state electrical inspector and state-wide licenses for electricians.

Five members of the Kansas Legislature, all lawyers, have been selected by the speaker to investigate the Kansas Public Service Commission, which came under fire from the legislators on the day of adjournment. The investigating body will begin its probe either in May or June. Lew T. Hussey, chairman of the Public Service Commission, says that he will welcome the investigation.

The Nebraska Senate has indefinitely postponed a bill, alleged by opponents to have been fathered by the power companies, to permit cities to levy double the present limit of taxation for extending lighting facilities and for purchasing energy. It was introduced by House members who said its purpose was to enable the cities to levy enough taxes to establish and operate municipal plants if the power companies failed to keep rates to a reasonable level.

Few bills affecting public utility companies were passed by the Oklahoma Legislature, which adjourned March 24, although many such measures were introduced. Among measures which would have affected public utility companies if enacted into law, but which were killed either in committees or on the floor, were four bills seeking to repeal the revocable-permit act, a bill making all corporations as well as individuals subject to the state income tax law, another providing that public service corporations should be assessed on the same basis as their valuations for rate-making purposes, and one regulating the collection of deposits by public service corporations for installing water, gas and electric meters. One measure which passed both houses creates a Conservation Commission, which is to have its headquarters with the State Board of Public Affairs and to consist of three members appointed by the Governor. In addition to handling drainage and irrigation matters, this commission is to supervise, conserve and develop the water power of the state and to grant permits for developing such water power or to undertake its development for the state, when private development may be inadequate or unsatisfactory, on such terms as may be determined by the Legislature. This bill was at last advices awaiting the Governor's action.

Charging that the water-power resources of Wisconsin are of benefit to private interests rather than to all the people of the state, the State Senate has appointed a special committee to gather all possible information concerning the development, utilization, control, ownership and regulation of such resources.

Maine Situation Improves

Smith Bill, Favored by Power Companies, Passes Senate, and Executive Approval Is Hoped For

PROSPECTS for the passage of legislation to permit surplus hydro-electric power exportation from Maine have improved substantially during the past fortnight. The Smith bill, sponsored by the power companies, passed the Senate last week, but final action has yet to be taken and the attitude of Governor Brewster is uncertain. He is understood to favor a bill providing for the negotiation of interstate compacts under which power may be exported. In many quarters it is believed that the Smith bill does not conflict with such legislation.

In a statement issued last Saturday, President Walter S. Wyman of the Central Maine Power Company asserted that the passage and popular ratification of the Smith bill would mean the investment in Maine of more than a hundred million dollars within the next ten years. Several plants costing from fifteen to twenty-five million dollars each would be involved. Maine has developed and ready for market today power to the amount of about 150,000,000 kw.-hr. a year, which, if used in southern New England, would save more than 100,000 tons of coal in 1927, bring the electric companies of Maine over $500,000 additional income and enable them to make lower rates to their present customers. The larger rivers can be developed to produce about three billion kilowatt-hours per year of additional power, and the utilization of this in place of steam would save more than two million tons of coal a year.

The sudden death on Wednesday of Senator Carter of Androscoggin, the chief antagonist of power exportation left on the field since former Governor Baxter sailed for Italy, halted legislation for this week. Mr. Carter was the author of bills to divorce generation of electricity from its transmission.

Ex-Governor of West Virginia Against Power Bill

A joint legislative hearing on the water-power bill now before the West Virginia Legislature was held at Charleston on March 30 in which the question of exportation of power figured extensively. Former Governor H. D. Hatfield said that the state's water power should not be controlled by any administrative body such as the public service commission, as proposed in the bill, but should be kept in the legislature or in the courts. He felt the legislature should grant permits to water power companies individually and should act on reports provided by the public service commission.

State Senator D. M. Willis of Mor-

gantown and Gray Silver of Martinsburg, speaking in opposition to sections of the bill, also advocated the use of the state's water power for its own industries. Senator Willis favored gradual development as the power was needed within the state, and Senator Silver declared for a joint survey of water-power sites by the state and federal government.

The bill under discussion authorizes the granting of licenses for water-power development to approved public service corporations on which right of eminent domain would be conferred, makes these corporations subject to regulation by the Public Service Commission or some other body set up for the purpose, the Governor to become a member as regards the granting or amendment of licenses for water-power development; imposes a state royalty on income from production of energy, regulates the construction of dams, and reserves to the state the right to develop streams or parts thereof on which no rights have been granted or on which such rights have been legally terminated.

Rocky Mountain Men Meet

Committee Conference of N.E.L.A. Division and the Colorado Public Service Association

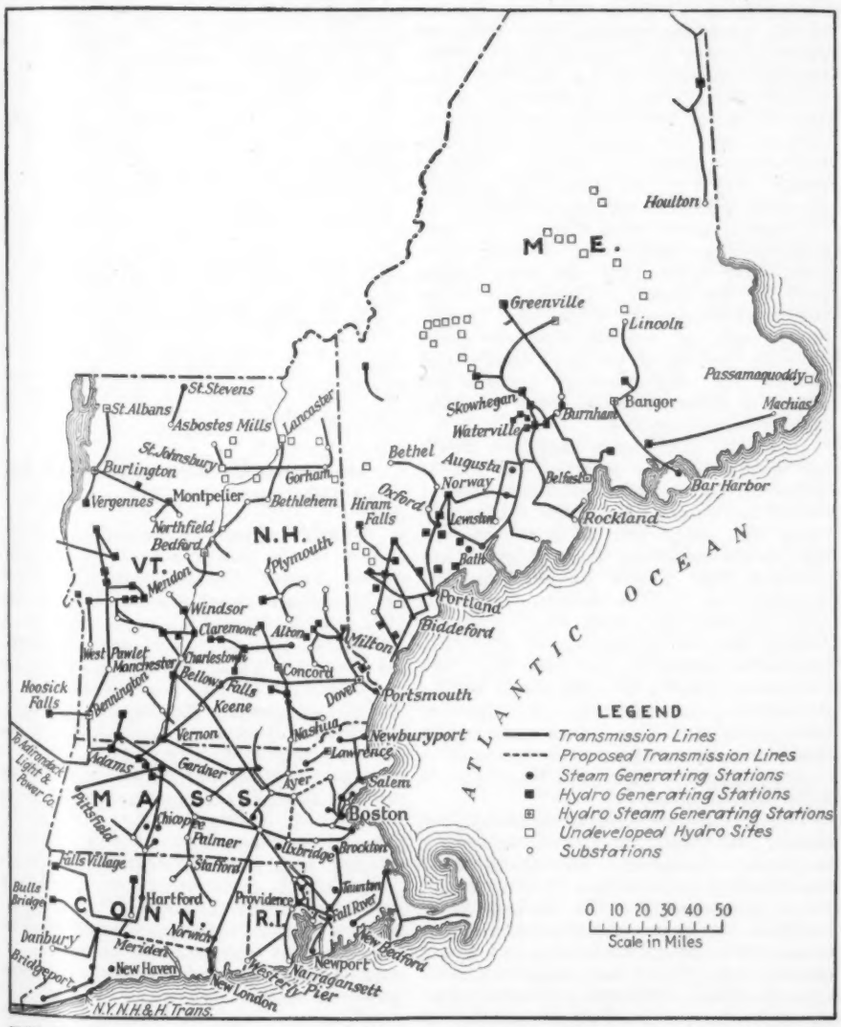
SEVENTY-FIVE committee members of the Rocky Mountain Division, N.E.L.A., and the Colorado Public Service Association met at Colorado Springs on March 21 and 22 for a two-day conference, New Mexico and Wyoming as well as Colorado being represented. Animated discussions covering such subjects as electric ranges, refrigerators and water heaters, highway lighting, rural electrification and public and industrial relations brought out information and opinions of no little value.

Arthur Prager of Albuquerque, N. M., president of the Rocky Mountain Division, dwelt upon the necessity for a more definite "tie-in" with the activities of the national sections. G. B. Buck, chairman Commercial Section, called for a new selling attitude on the part of central-station companies and the employment of salesmen of a higher type at better pay. H. H. Kerr advocated range campaigns, declaring that the Mountain States offer great possibilities for increasing central-station load in this way.

George Bakewell, Jr., executive manager of the Electrical League of Colorado, endeavored to show that high standards of electric wiring, when backed up by an enforced local ordinance, tend to increase, rather than decrease, the adequacy of residence wiring layouts. J. E. Loiseau told about new insurance policies now available for utility companies, and other informative talks, provocative of worthwhile discussion, were made by J. F. Greenawalt, president of the Colorado Public Service Association; G. E. Lewis, executive manager Rocky Mountain Committee on Public Utility Information; J. A. Clay, whose topic was rural service; L. R. Storey, who talked on the range situation; F. A. Tewksbury, on accident prevention; Clare N. Stannard, on industrial relations; E. F. Stone, on customer ownership, and others.

H. S. Sands reported for the legislative committee, pointing out the menace of municipal funding on the income-warrant plan. H. H. Kerr appealed for assistance of central-station engineers in the coming Rocky Mountain Division power survey. O. A. Weller, division secretary, spoke on association relationships, and W. J. Benning, chairman of the Accounting Section, reported for that body.

Interconnected Transmission Network in New England



IN THE above power map of New England, prepared by the electric light and power companies at the request of the New England Council and used, as reported last week, by Charles L. Edgar, president Boston Edison Company, in his recent address before the Council, are incorporated data never before assembled and made public. The map shows the network of main transmission lines with which separate steam and water-power plants are interconnected, the largest steam plants, the largest water-power plants and the chief sites of undeveloped water power. It does not show small plants or lines.

American Electrical Engineer Murdered in Mexico

Press dispatches from Mexico City tell of the prompt capture and execution by the Mexican government of seven bandits said to belong to a band that kidnapped and murdered Edgar M. Wilkins, an American electrical engineer who, the report says, hailed from Savannah, Ga.

Wilkins and his ten-year-old son were seized on Sunday, March 27, near Jocotlan by an armed group who later sent the boy into Guadalajara with a demand for $20,000 ransom. Wilkins' body was found a week later near Cerro el Colli, a short distance from Guadalajara. It is supposed that Mexican troops pursuing the bandits opened fire on them, thus forcing them to retreat to the mountains. Finding Wilkins a hindrance in their flight, the kidnappers, it is believed, assassinated him. This version of the killing has, however, so far remained unconfirmed.

Mr. Wilkins is said in the press dispatches to have been the engineer in charge of the plant of the Chapala electric company (Cia Hidroelectrica é Irrigadora del Chapala) at Guadalajara, of which the executive officers are Mexicans of Mexico City and Guadalajara. The Year Book of the American Institute of Electrical Engineers for 1927 (just issued) lists him as an engineer with Frank & McLaughlin & Company of Mexico City.

International Economic Conference at Geneva

President Coolidge last week appointed five American delegates to the International Economic Conference to be held at Geneva, Switzerland, May 4, a gathering from which important results are expected. The President's appointees are Henry M. Robinson of Los Angeles, who served on the Dawes Commission and is a member of the General Electric Company board; Norman H. Davis of New York, Assistant Secretary of the Treasury and Assistant Secretary of State in the Wilson administration; John W. O'Leary of Chicago, president of the Chamber of Commerce of the United States; Alonzo E. Taylor of Stanford University, who is especially familiar with agricultural problems, and Dr. Julius Klein, director of the Bureau of Foreign and Domestic Commerce and an authority on international economic questions.

In order to give American engineers and industrialists first-hand information on the deliberations and conclusions of this conference the McGraw-Hill Publishing Company is sending Edward J. Mehren, one of its vice-presidents, to the meeting. He will sail on April 20, on the same ship with the American delegates and experts.

More Late Figures on Canadian Water Power

A detailed report on the water-power resources of Canada just issued by the Dominion Water Power and Reclamation Service places the per capita utilization of water power in the Dominion at 485 hp. per 1,000 population. Dealing with water power in the central electric station industry, the report states that almost 81 per cent of Canada's total hydraulic installation is for public distribution. As the percentage of hydraulic development for central-station use is increasing from year to year, the electrical output of hydraulic central stations has shown a corresponding increase over the output of those stations using fuel as a source of primary power, until during the year 1925, the last for which definite figures of output are available, more than 98.3 per cent of the total electrical output of Canada's central stations was generated by falling water.

At the present time there are 303 hydro-electric generating stations in Canada, with a combined installation of 3,685,428 hp., of which more than 3,000,000 hp. is developed in the highly industrialized but non-coal-producing provinces of Ontario and Quebec. Although the installations in these two provinces are almost equal—1,508,266 hp. in Ontario and 1,546,692 hp. in Quebec—in Ontario the installation of the commercial stations is less than 40 per cent as large as that of the municipal stations, being only 28.4 per cent of the total for the province, while in Quebec the commercial stations have an installation representing 98.8 per cent of the total for that province.

The report says that a conservative estimate of the capital investment in the Canadian water-power industry, including development, transmission and distribution, amounts to more than $840,000,000.

A paragraph deals with the coal equivalent of developed water power in Canada, as follows: "Taking into account all present conditions surrounding water-power development in Canada and comparing them with somewhat similar conditions of fuel development elsewhere, it is reasonable to state that a saving of coal of 6 tons per annum is capable of being effected by each installed horsepower. This means that the total present water-power installation of 4,556,000 hp. is capable of effecting a saving of about 27,000,000 tons of coal per annum."

More Electric Power Needed in Mining Industry

At the second annual industrial development conference of the Southern Division of the American Mining Congress, held in Birmingham recently, states from Virginia to Texas, twelve in all, were represented. The value of electric power in bringing about industrial development was a leading topic. Henry Mace Payne, consulting engineer of the American Mining Congress, brought out the relationship that electric power bears to mining developments and general industrial growth. He said that the mining industry has in recent years come to realize that power plays a large part in its development and must play an even larger part in the future. There are to be found in successful production in the South coal, ore, marble, clay and other deposits that could not have been mined except for the energy transmitted over the interconnected lines of light and power companies.

However, Mr. Payne said, the South has not made the progress in manufacturing its mineral products that it should have done. Economic forces will bring this about just as in the case of the textile industry. It is of great importance that power be available for transmission to the mines. Undeveloped deposits of great value exist in Mississippi and Georgia, for instance, but unless power is provided their development will be delayed if not wholly prevented. A real duty, the speaker said, rests upon the power industry in the South to extend its lines and also to keep in close touch with the research work that is going on.

The water-power resources of the South, Mr. Payne said, will, according to geological surveys, be exhausted at the present rate within twenty years. Even at present, it is necessary to augment water power with large steam plants built where both coal and water can be had. There is a necessary relation, therefore, between coal and water power in the service they are rendering the public and industry. It is also important to the mining industry that power resources be developed and energy transmitted to every part of the section, under public regulation as to rates and service. Nothing will be so harmful to the South as to take out of public service any of the important water powers. The mining industry must demand of the power industry that it continue to perform its service and of public officials that no obstacles be placed in the way of the development and transmission of energy for public use.

Aim to Finish Guadalupe River Hydro Plants in Fall

Contract for the sale of the electric power which will be generated by the three plants to be constructed on the Guadalupe River between Seguin and New Braunfels, Texas, has been made by F. H. Willmont of Seguin and associates with the San Antonio Public Service Company. The power dams and plants which the Willmont interests now have under construction and which have been described before will cost $2,000,000. Financing has been about completed and the General Electric Company will supply all the electrical equipment.

This project, it will be recalled, consists of three separate developments. The first is a dam 35 ft. high across the united streams of the Comal and Guadalupe at a point 8 miles below New Braunfels. The total fall here is 45 ft. The next development is a dam where the highway crosses the Guadalupe, 5 miles west of Seguin and 25 miles east of San Antonio. This will create a lake extending to the power plant of the first dam. The third development will be at a point 5 miles below Seguin and will consist of a dam and canal with a total head of 40 ft., making a lake which will extend to the site of the Seguin light and water plant. It is the expectation of engineers and contractors that the entire project will be finished and distribution of power in progress by the first of next October.

Alabama Power's Growth Is 1,000,000 Kw.-Hr. a Day

A daily increase of a million kilowatt-hours in the power output of the Alabama Power Company in 1927 over 1926 is the barometer by which Thomas W. Martin, president of the company, measures the continued upward trend of business in Alabama, as expressed in a statement issued following his return to Birmingham after a two months' stay in the North. "Continued demands for electrical energy during the remainder of the year on the same basis as the first 77 days will show an increase of approximately 365,000,000 kw.-hr. in the output of our company during this year over 1926," he said. "This will necessitate the constant building of power dams by us to keep pace with the growth and has caused us to speed up construction schedules on our Lock 18 and upper Tallassee projects now under way. We are extending our lines not only to the larger centers but to the smaller communities in the rural sections. So that in addition to carrying to them the comforts and conveniences of electricity, we are giving the people of these communities an equal opportunity with the larger centers to establish manufacturing enterprises."

Purchases and Mergers

Fitkin Sells His Interest in Western United Corporation—Foshay Buys Nogales (Ariz.) Plant

ANNOUNCEMENT was made this week by A. E. Fitkin of New York that he had sold his interest in the Western United Corporation to the banking firm of E. H. Rollins & Son, to which he sold half of the majority stock when he acquired control of the corporation early last year. Under it have been grouped the subsidiaries of the Western United Gas & Electric Company, serving Aurora, Elgin, Murphysboro and other Illinois communities. Mr. Fitkin still retains Fitkin Utilities, Inc., and the Inland Power & Light Corporation, which controls operating companies in Michigan, Arkansas, Kansas and Missouri.

Application has been made to the Kansas Public Service Commission for authority to sell the municipal electric light plant at Gaylord to the United Light & Power Company of Downs. The latter company is controlled by the Kansas Power Company, Concordia, an A. E. Fitkin subsidiary. Consolidation of the Fitkin properties in Kansas is forecast in persistent rumors from reliable sources. The most important are in Concordia, Great Bend, Dodge City, Phillipsburg and Liberal.

The W. B. Foshay Company has bought the Southern Arizona Power Company, supplying Nogales, Ariz., on the Mexican border, with electricity, gas and artificial ice and valued at about $1,600,000, and announces also that a group of properties in Utah, Nevada and Kansas with a physical valuation of over $5,000,000 is under consideration.

It is just announced that the outstanding common stock of the Shenandoah River Power Company of Weyer's Cave, Va., has been acquired by the Atlantic Public Utilities, Inc., of Boston. Philadelphia investors are interested in the Shenandoah River Power Company, which is said to contemplate a hydro-electric plant 18 miles south of Luray, Va.

The Chester (Mass.) Electric Light Company, owned and operated by L. LeRoy Gardner, is to be taken over by the town for a consideration yet to be arranged.

The New York Public Service Commission has granted the petition of the Tusten Light & Power Company for permission to transfer its plants in the towns of Cochecton, Highland and Tusten, Sullivan County, to the New York State Gas & Electric Corporation. Joint petition has been made to the commission by the Hermon Electric Light Company and the St. Lawrence County Utilities for consent to the transfer of the plants of the Hermon company in Hermon and the towns of Canton, DeKalb, Hermon and Russell in St. Lawrence County to the St. Lawrence concern.

The Central Illinois Public Service Company has asked the Illinois Commerce Commission for authority to take over the electric light plant at Fowler, Ill., now owned by W. F. Seckman.

The Roscoe (Ill.) Electric Company has been purchased by Milton Ellis, owner and operator of the Rockford city traction and interurban lines, for $250,000 from Stuart Ralston.

A petition asking authority to purchase the Thompson Company distributing system in Milan, Ripley County, Ind., and Mooreshall, Dearborn County, and between Aurora and Milan, for $46,000, has been filed with the Indiana Public Service Commission by the Interstate Public Service Company.

Seward, Neb., has definitely gone out of the electric lighting business, having sold its generators to the town of Madison. The Blue River Power Company, which recently sold out to the Nebraska Gas & Electric, was originally a Seward enterprise.

For the second time within three months the voters of Alma, Neb., have turned down a proposal to sell the municipal lighting plant, this time by a three-to-one vote. The Western Public Service Company had offered to buy the plant.

Cape Charles, Va., has disposed of its electric distributing system to the Eastern Shore Gas & Electric Company for $55,000, the company to take possession Aug. 31.

The Georgia Power Company has purchased for $40,000 cash the Metter (Ga.) municipal light plant, which is on the route of a 44,000-volt transmission line the company is about to build from Statesboro to Swainsboro, a distance of about 40 miles.

Sale of the municipal light and power plant at Milton, Fla., to the Gulf Power Company for $65,000 is announced.

The Central Texas Light & Power Company of San Antonio has purchased the electric plants of the Citizens' Utilities Company at Flatonia and also of Pearson & Johnson at Waelder, 12 miles west of Flatonia.

The Southwestern Gas & Electric Company of Shreveport, La., has purchased the power plants and other utilities operated by the Gulf States Utilities Company in Mooringsport, Oil City and Vivian, La. The Winnsboro (La.) municipal light and power plant has been taken over by the Louisiana Power & Light Company.

Purchase of the Pacific Gas & Electric Company's lighting system at Oroville, Cal., by the city was defeated on March 24 at an election to determine whether the city should be bonded for $150,000 for that purpose. The vote was 649 against, 398 for.

Apparatus Committee Hears of Progress in Generation

Technical studies for increasing the service reliability and efficiency of generating stations largely occupied the attention of the apparatus committee of the N.E.L.A. at its Niagara Falls meeting on March 31-April 1. H. R. Woodrow, chairman of the committee, presided. The work of the sub-committee on generating stations, J. A. Johnson chairman, formed the chief topic for discussion. About eighty electrical engineers from representative utility properties were in attendance and enjoyed the hospitality of the Niagara Falls Power Company. Trips were made to the plants of the local utility and to the Huntley station of the Buffalo General Electric Company.

A discussion was held on the possibilities of greater voltage standardization, and progress reported was encouraging. At another session several engineers designed imaginary generating stations and the differences in design provoked an animated discussion. Simplicity in layout and unit features were accented as essential requirements. Troubles of a serious character with apparatus have been absent this year, according to reports of utility engineers, and, in general, equipments of present design are found satisfactory. Improvements in stability through the use of high-speed excitation systems were discussed by representatives of the General Electric Company, the Westinghouse Electric & Manufacturing Company and the American Brown Boveri Company.

The last meeting of this committee will probably be held in Pittsburgh about May 1.

Power Resources in Iowa Are Thoroughly Canvassed

As noted briefly last week, the program of the Iowa Power Conference held at Iowa City under the auspices of the College of Engineering and the extension division of the University of Iowa on March 30 and 31 was devoted to considering power resources, generation, transmission and utilization in Iowa. After Joe Carmichael, director of the Public Utility Information Bureau, had given an excellent résumé of the general situation, Prof. F. A. Nagler discussed water-power development in the state, showing that while the total water power generated had increased, the number of plants had decreased owing to the discontinuance of small installations. W. C. Tegtmeier, vice-president and general manager Central States Power & Light Corporation, recounted the experience of his company with water power in the northeastern part of the state, the portion best adapted to hydro-electric development. H. R. Summerhayes, chief engineer central-station department, General Electric Company, described recent technical development in power transmission.

Dean C. C. Williams gave a résumé of the fundamentals of power rates, and Prof. A. H. Ford, head of the electrical engineering department, pointed out the possibilities for interconnection in Iowa. John A. Reed, vice-president and general manager Iowa Electric Company, and others who discussed Professor Ford's paper expressed the opinion that smaller systems rather than superpower zones are the best adapted to conditions in the state.

The utilization of Iowa coal, which formed the theme for one half day, brought out spirited discussion. T. A. Marsh, Combustion Engineering Corporation of Chicago, showed both by laboratory test data and plant operating results that Iowa coal can be used economically where the combustion chamber is properly designed. E. F. Bulmahn, vice-president and general manager Iowa Southern Utilities, speaking for a company that operates mines as well as power stations, maintained that with economies in mining

Iowa coal could compete with that from Illinois and Kentucky.

Dean G. F. Kay, state geologist, made a striking exhibit of the mineral resources of the state that could be developed through the use of power, and W. J. Maytham, engineer Northern States Portland Cement Company of Mason City, presented the experiences of his company in the use of power in manufacturing cement. The papers of R. J. Eustace, Industrial Commissioner of Davenport, under the title "Power—the Pioneer Factor in Developing Industry," and Arthur Schwerin, executive secretary of the Burlington Willow Ware Company, under the title "Economic Conditions Controlling Manufacturers in Iowa," set forth the advantages of using electrical energy in manufacturing in Iowa.

International High-Tension Transmission Congress

The fourth International High-Tension Transmission Congress is to be held in Paris from June 23 to July 2. The work of the conference will be divided into three main divisions, to each of which two days will be allotted. These divisions will consider respectively the production of power, the construction of transmission lines and the operation of transmission systems. Two days will be devoted to excursions and visits to electrical installations in the Paris district.

Dean Snow on Cultural Education for Engineers

A somewhat novel viewpoint on the cultural education of engineers is expressed in the annual report of Dean Charles H. Snow of the School of Engineering of New York University in his annual report to Chancellor E. E. Brown, recently made public. Dean Snow points out that basic courses in engineering combined with cultural work are the foundation of all undergraduate study in the technical field. While he urges a liberal admixture of cultural training as a preparation for engineering, he believes that courses as given in liberal arts colleges are not properly arranged for engineering students.

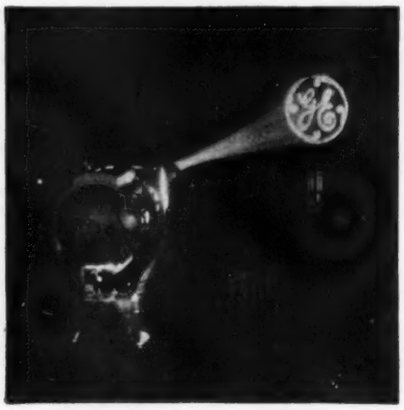
"Several years passed in a college of liberal arts," he said, "constitute the worst possible training for youths who wish to become engineers. In so far as possible, general culture subjects and the pure sciences should be taught from an engineering point of view by engineers."

The dean is also critical concerning a tendency toward excessive specialization which he observes. Ten separate degrees in engineering are now given at New York University, he says, and as fast as instruction is provided for some new development in engineering pressure is brought for another degree to correspond to the new specialty. "This situation is not peculiar to our own institution," Dean Snow observes, "but exists in practically all schools of technology in the United States. It has no precedent in the older professions, nor is it entirely warranted in the engineering profession itself."

Briefer News

Maine Engineers to Organize.—The organization of an association of engineers from the various public utilities of Maine for consideration of common problems is in prospect, and a meeting toward such an organization was held in Portland last week, at which engineers from Maine light and power companies and telephone companies were present, as well as visiting engineers from Boston and New York.

Painting Electric Pictures on Clouds.—A long-range searchlight gun which can shoot pictures or images on clouds or buildings at varying distances, depending on atmospheric and cloud conditions, has been perfected by the General Electric illuminating engineering laboratory. This projector, which in external appearance closely resembles a cannon with its tapering barrel painted a battleship gray, is a model of larger sky writers which can be made, according to W. D'Arcy Ryan,



director of the laboratory. A searchlamp is installed at the rear end of the so-called gun, and in the barrel are lenses and a slot for inserting the slide which is to be projected. These lenses are so arranged that the image from the slide is in constant focus at any distance more than 20 ft. from the end of the barrel, which makes it possible to throw the image on various objects at different distances without refocusing. The image can be reflected in ever-changing colors by use of an electrically operated screen attached to the nozzle of the projector. The speed of this screen can be varied. "There is no reason why we cannot make projections using a 60-in. searchlamp which will be capable of casting an image on a cloud or other object at a distance of five miles," Mr. Ryan explained. "The present gun uses an 18-in. searchlamp, which can be used with either an incandescent lamp or a carbon arc."

Electrical League of Utah Has New Quarters.—Headquarters of the Electrical League of Utah have been moved from the Kearns Building, Salt Lake City, to the Newhouse Hotel, where commodious quarters on the mezzanine floor now serve the purpose of clubrooms. The annual convention of the electrical interests of the Intermountain territory, sponsored by the Electrical League of Utah, will take place in Salt Lake City on April 25. J. M. Perlewitz, manager of the local branch of the Graybar Electric Company, is chairman of the convention committee.

New Foshay Building in Minneapolis Will Have 22 Stories.—Taking advantage of recent changes in the Minneapolis building ordinance, the W. B. Foshay Company has altered its plans, previously reported, for a twelve-story office building to cost $1,000,000 and will erect a building of 22 stories to cost from $2,000,000 to $2,500,000. This building, to be erected in the block bounded by Marquette and Second Avenues and Eighth and Ninth Streets, will be the highest in the city.

Fifth Member of Colorado River Commission Named.—Secretary Work's Colorado River Commission, in addition to Senator Charles W. Waterman, William F. Durand, James R. Garfield and James G. Scrugham—the four members named last week—will include Governor Frank C. Emerson of Wyoming as the fifth member. The commission is to investigate the Colorado River situation and report its findings to the next Congress in December of this year.

Keokuk Plant to Be Enlarged.—The North American Company has announced that additional construction calling for the expenditure of $2,500,000 will soon be started at the hydroelectric plant of the Mississippi River Power Company, at Keokuk, Iowa, from which power is widely distributed in Mississippi Valley states. The rating of the plant will be increased from 135,000 kw. to 175,000 kw., and it is planned to complete the work early in 1929.

American Electrical Standards in Spanish.—The United States Commerce Department's committee on pan-American standardization reports that copies of a Spanish edition of A.I.E.E. Standards Nos. 1, 5, 8, 10 and 11 have just been released and can be had from the Bureau of Foreign and Domestic Commerce, No. 1 at 5 cents, the others at 10 cents each. Their publication follows that of Section 7 of the A.I.E.E. Standards, which was issued last December as the first of a series for distribution in Spanish-speaking countries.

Municipal Plant of Kansas City, Kan., Still Under Fire.—A suit to oust the Commissioner of Water and Light at Kansas City, Kan., C. D. Darnall, was set for hearing in the Supreme Court of the state on April 8. The suit grew out of alleged irregularities in the conduct of the municipal departments of which Mr. Darnall is head. An investigation into the water and light situation last summer (ELECTRICAL WORLD, July 24, 1926, page 192) disclosed that paper profits of more than $1,800,000 were fictitious and that a considerable deficit actually existed. At the annual stockholders' meeting of the Kansas City (Mo.) Power & Light Company President J. F. Porter discussed frankly the suggested acquisition of the munic-

ipal plant across the river, saying that while the addition of an annual demand for 75,000,000 kw.-hr. to the 340,000,000 kw.-hr. output of the utility company plant might permit a reduction of rates, he would not enter a "contentious situation" and did not desire unwilling customers.

N.E.M.A. Changes Convention Date.—The date of the convention of the National Electrical Manufacturers' Association at Hot Springs, Va., originally set as June 13-18, has been changed to May 28-June 4, just preceding the N.E.L.A. convention at Atlantic City.

Further Electrification of the Chicago, Milwaukee & St. Paul.—Another 212 miles of main line of the Chicago, Milwaukee & St. Paul Railway—from Othello, Wash., to Avery, Idaho—will soon be electrified, according to local officers at Spokane, giving the company 881 miles of continuous electric transportation. Plans will be presented to the receivers this spring as soon as the new financing plan of the road is approved. The cost would be more than $7,000,000.

Utah and Idaho Systems Will Have 132-Kv. Interconnecting Line. — Interconnection of the Utah Power & Light Company's system with that of the Idaho Power Company is proposed in the application made by the former to the Federal Power Commission for a license to construct an 82-mile transmission line from its switchyard at Wheelon, Utah, to the Idaho Power Company's American Falls plant. The new line will be constructed on wooden poles and will carry 132,000 volts. Its cost is estimated at $500,000.

Growth of Illinois Power & Light.—The Illinois Power & Light Company is completing construction of a high-tension transmission link connecting its lines with those of the Central Indiana Company at the state border. The line, though only 7 miles long, ties into the line extending northward to Terre Haute and this guarantees the territory against interruption of service. The new boilers and turbines at the Danville power house, which will increase its capacity 75 per cent, will be ready by May 1.

Another Tidal Power Project.—A bill for the incorporation of the Petitcodiac Tidal Power Company, which has as its object development of the tidal power of the Petitcodiac River in New Brunswick, where it is estimated that between 100,000 hp. and 200,000 hp. could be developed at an estimated cost of $23,000,000, was introduced recently in the New Brunswick Legislature. If this project is carried out, it will make possible, promoters say, the electrification of the entire Canadian National Railways between St. John and Halifax. Matthew Lodge of Moncton, N. B., director of the Canadian National Railways and one of the incorporators of the company, said that the proposition had the approval of Dexter Cooper, the promoter of the Passamaquoddy tidal development.

Electricity in Irish Free State to Be Government Monopoly.—Dublin advices say that the Shannon electricity supply bill of the Irish Free State government provides for the distribution, control and sale of the energy by means of a state monopoly, under the control of a board of not fewer than three and not more than seven members. This board, appointed by the government, will have power to acquire all existing electrical undertakings in the Free State, of which there are about 90, including authorized but not completed plants. After 1932 the Shannon scheme must become self-supporting, and the board must regulate the cost of electricity throughout the country in such a way as to cover all expenses. The new board will have comprehensive powers, including the right to sell electrical equipment and materials.

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations, with their secretaries, is published in the first issue of each volume. For latest list see ELECTRICAL WORLD for Jan. 1, page 80.]

Southeastern Division, N.E.L.A.—Peabody Hotel, Memphis, Tenn., April 13-15. C. M. Kilian, 404 Wynn-Claughton Bldg., Atlanta.

American Institute of Electrical Engineers — Middle Eastern District, Bethlehem, Pa., April 21-23; Northeast District, Pittsfield, Mass., May 25-27; summer convention, Detroit, June 20-24. F. L. Hutchinson, 36 West 39th St., New York.

Southeastern Water and Light Association—Jackson, Miss., April 26-28. W. F. Steiglitz, Columbia, S. C.

Southwestern Division, N.E.L.A.—New Orleans, April 26-29. S. J. Ballinger, San Antonio Public Service Company, San Antonio, Tex.

Southwestern Public Service Association — New Orleans, April 26-29. E. N. Willis, 403 Slaughter Bldg., Dallas, Tex.

Nebraska Section, N.E.L.A.—Grand Island, Neb., April 27-28. H. M. Davis, 1519 O St., Lincoln.

American Electrochemical Society — Benjamin Franklin Hotel, Philadelphia, April 28-30. Colin G. Fink, Columbia University, New York.

Electrical Supply Jobbers' Association —Greenbrier Hotel, White Sulphur Springs, W. Va., May 4-6. Franklin Overbagh, 411 South Clinton Street, Chicago.

Missouri Association of Public Utilities —Cape Girardeau, May 5-7. F. D. Beardslee, 315 North 12th St., St. Louis.

Middle West Division, N.E.L.A. — Topeka, Kan., May 18-20. H. M. Davis, 1519 O St., Lincoln, Neb.

American Society of Mechanical Engineers—White Sulphur Springs, W. Va., May 23-26. C. W. Rice, 29 West 39th St., New York.

Canadian Electrical Association—Clifton Hotel, Niagara Falls, Ont., May 25-27. J. B. Woodyatt, Southern Canada Power Company, Montreal.

National Electrical Manufacturers' Association—The Homestead, Hot Springs, Va., May 28-June 4. S. N. Clarkson, 30 East 42d St., New York.

American Association of Engineers—Tulsa, Okla., June 6-8. M. E. McIver, 63 East Adams St., Chicago.

National Electric Light Association—Atlantic City, N. J., June 6-10. Paul S. Clapp, 29 West 39th St., New York.

Pacific Coast Electrical Association—Santa Cruz, Cal., June 14-18. S. H. Taylor, 447 Sutter St., San Francisco.

North Central Division, N.E.L.A.—Lake Superior steamboats from Duluth, June 17-20. J. W. Lapham, 351 Loeb Arcade, Minneapolis.

Northwest Electric Light and Power Association—Salt Lake City, June 21-24. C. W. Lundquist, Utah Power & Light Co., Salt Lake City.

Electric Bond & Share Company Moves. — The Electric Bond & Share Company, which has occupied for several years a number of floors in the buildings at 71 Broadway and 65 Broadway, New York, is moving into its own building known as Two Rector Street. The company bought the building more than two years ago, since which time it has added three stories, making 26 in all, and has thoroughly modernized it in every respect. It will occupy for its own organization fourteen of the floors. The president and vice-presidents will occupy the twenty-second.

Consumers Power Company Continues Its Conservation Policy.—Two hundred thousand tiny Norway pine, white pine, jack pine, willow, poplar and locust trees will be planted along the banks of Michigan rivers this year by foresters of the Consumers Power Company, according to a report received by the Michigan Public Utility Information Bureau. This year's program follows three years' successful experimental planting of 80,000 trees and is part of the company's conservation policy, which includes the planting of fish in streams on which its hydroelectric stations are built—2,000,000 fish being planted in 1926.

Johns Hopkins Not Altering Its Engineering Courses. — Comment in the daily press on the future status of the School of Engineering at Johns Hopkins University has led Dr. Frank J. Goodnow, president of that university, to issue the following statement: "Much interest has been displayed in the new plan for university work at the Johns Hopkins University. This plan applies particularly to the philosophical faculty. For the present the School of Engineering will continue as formerly to offer its regular four-year undergraduate courses and graduate instruction. Only such changes in curricula will be made as are necessary to conform with the modified courses in the College of Arts and Sciences."

Alberta Decides for Public Ownership of Spray Lakes Project. — The Province of Alberta, Canada, has finally gone on record as being desirous of making the Spray Lakes hydroelectric power project a public utility owned and operated by the province. For a long time the provincial government had been debating the question whether to proceed with this development as a public ownership project or to hand it over to private interests. The Calgary Power Company had offered to build the proposed plant and later sell the undertaking to the provincial government. Meanwhile there is a demand for more power from Calgary, Lethbridge, Edmonton and other Northwest cities. The ultimate idea is to serve the entire province, but the initial development would provide

only for the immediate needs of the major cities and some of the towns on the Calgary & Edmonton Railway. The outlay for this would probably be about $1,500,000, but if the complete scheme is ever carried out, it will represent an investment of nearly $15,000,000. Consent of the Dominion government is a prerequisite, and it is quite likely that opposition will be met since the Spray Lakes are in Banff National Park.

Three Divisions of Ontario Hydro to Be Amalgamated.—Amalgamation of the Central Ontario Hydro-Electric System with the St. Lawrence and Rideau systems was forecast in the Provincial Legislature recently by John R. Cooke, government member of the Hydro-Electric Power Commission, who also announced a 20 per cent rebate to rural customers on their payments for 1926. He said that the commission held reserves on the five systems of $377,894 and it was proposed to set up 20 per cent of the cost of operation as stabilization.

San Francisco Entertains Plan for Municipal Utilities Commission.—The Board of Supervisors of San Francisco is having its legal advisers look into the possibility of the city's setting up a commission of its own to control all municipally owned utilities. This movement is the outgrowth of a less comprehensive plan to establish a waterworks commission to administer the Hetch Hetchy and Spring Valley water properties. A forty-million-dollar bond issue for the purchase of Spring Valley is to be voted on in the spring. The desire is to find a way to set up nonpolitical control of the city's extensive public service holdings.

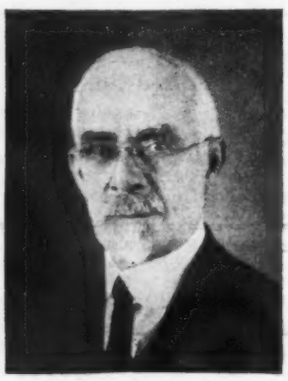
Irrigation and Electricity in Oregon.—Electric power for pumping irrigation water will play a part of greater importance than ever in Oregon's reclamation districts in the near future, according to State Engineer Rea Luper. He bases this assertion on recent legislation both in the interest of reclamation of new lands and to aid the completion of many large and small irrigation projects which have long been delayed on account of the state's neglect properly to supervise their construction and financing.

Washington Water Power's 110-Kv. System Now Extends 429 Miles.—The recent placing of 127½ miles of transmission line in operation at 110,000 volts between the Long Lake power station and the Coeur d'Alene mining district of northern Idaho gives the Washington Water Power Company lines at that voltage completely across its system from the Idaho Panhandle to the Columbia River. Its lines interconnect with the lines serving the Chicago, Milwaukee & St. Paul Railway and with the Puget Sound Power & Light Company's system in the Seattle district. The Washington Water Power Company has rebuilt 67 miles of old 60,000-volt line to reach the mining district and raised the voltage of 60 miles of comparatively new line from 60,000 to 110,000. A total of 429 miles of 110,000-volt lines is now owned and operated by the Spokane company.

Men of the Industry

C. D. Flanigen New Vice-President of Georgia Company

C. Douglas Flanigen, who was elected vice-president of the Georgia Power Company as announced in the April 2 issue of the ELECTRICAL WORLD, first entered the public utility field as an employee of the Athens (Ga.) Gas Light Company in 1883, remaining as manager until 1890. In that year Mr.



C. D. FLANIGEN

Flanigen left the utility field to join the staff of the Athens *Daily Banner* in the capacity of business manager and to become engineer for a development company, returning to the public utility field in 1894 as superintendent of the Athens Electric Railway Company. He occupied successively the positions of general manager, vice-president and president of that company and its successor, the Athens Railway & Electric Company. His election to a vice-presidency in the Georgia Power Company followed the merger of the Athens properties into the Georgia Power Company last month.

He received his technical training at the Polytechnic College of the State of Pennsylvania and at the University of Pennsylvania, later supplementing his engineering knowledge with industrial training in the steam-hammer and machine-tool shop of Ferris & Miles and with three years' experience in mercantile business. Mr. Flanigen's activity has by no means been confined to the performance of his executive duties with the Athens Railway & Electric Company. He is a past-president of the Southeastern division of the National Electric Light Association, the Athens Chamber of Commerce and the Rotary Club of Athens and a member of the Public Utilities Information Bureau of Georgia and of the American Electric Railway Association. He was a member and secretary of the board of education of the city of Athens from the inauguration of the free schools in 1885 until he resigned in 1923.

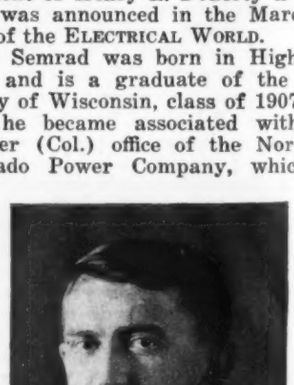
Samuel D. Heed, president of the Electric Household Utilities Corporation, Chicago, since January, 1926, has resigned. Mr. Heed entered the manufacturing branch of the electrical industry after five years' association with the Union Gas & Electric Company of Cincinnati, first as general manager and then as vice-president in charge of public relations. **Neil C. Hurley** has been elected president to succeed Mr. Heed, and Mr. Hurley's position as chairman of the board has been resumed by his father, **Edward N. Hurley.**

M. H. Aylesworth, president of the National Broadcasting Company, Inc., sailed for Bermuda April 2 aboard the Royal Mail liner *Araguaya.* Before assuming the presidency of the National Broadcasting Company last fall Mr. Aylesworth had served as managing director of the National Electric Light Association.

C. A. Semrad Succeeds Mr. Irelan in St. Joseph

Charles A. Semrad, vice-president and commercial manager of the Public Service Company of Colorado, Denver, has been made vice-president and general manager of the St. Joseph (Mo.) Railway, Light, Heat & Power Company. He succeeds S. B. Irelan, who for the past four years has been general manager of the St. Joseph company and whose recent appointment as Western manager of the securities department of Henry L. Doherty & Company was announced in the March 26 issue of the ELECTRICAL WORLD.

Mr. Semrad was born in Highland, Wis., and is a graduate of the University of Wisconsin, class of 1907. In 1912 he became associated with the Boulder (Col.) office of the Northern Colorado Power Company, which in



C. A. SEMRAD

1915 was reorganized under the name of the Western Light & Power Company. In 1914 he assumed the management of the Cheyenne Light, Fuel & Power Company in Cheyenne, Wyo., a subsidiary of the Northern company, and later become manager of the Western Light & Power Company's properties, with headquarters at Boulder. In December, 1918, the Henry L. Doherty interests took over the Western company, and six years later Mr. Semrad

was transferred to Denver to assume the duties of vice-president and commercial manager, which position he has held until his recent promotion. For a number of years Mr. Semrad has been an outstanding figure in association affairs, being past-president of the Rocky Mountain Division of the National Electric Light Association, of the Colorado Public Service Association and of the Wyoming Public Utilities Association.

Changes in Personnel at Richmond

The election of William E. Wood to the presidency of the Virginia Electric & Power Company, Richmond, to succeed Luke C. Bradley and the resignation of W. C. Bell as general manager of light and power to become associated with Mr. Bradley in Rhode Island caused vacancies which have resulted in numerous advancements. The ELECTRICAL WORLD has already announced that J. Franklin McLaughlin will be in charge of operations of the company, with offices in Richmond, and that R. J. Throckmorton will become general manager of the electric department of the Richmond division, including the Carolina and Northern districts.

Other changes have resulted as follows: Thomas P. Walker, who has previously been in charge of properties under Stone & Webster management in El Paso, Tex., will succeed Mr. McLaughlin as vice-president in charge of the Norfolk division. T. Norman Jones, Jr., will become general manager of the Norfolk division, including electric transportation and gas departments. John W. Keener will continue as superintendent of production and transmission for the entire system, reporting to the vice-president in charge of operations. J. B. Hayes, formerly assistant to the president, will become general superintendent of transportation of the Norfolk division, reporting to the general manager of the Norfolk division. R. C. Hopkins succeeds Mr. Hayes as assistant to the president and to the vice-president in charge of operations. Louis F. Riegel, heretofore sales manager for Richmond, will become general sales manager for the system, reporting to the vice-president in charge of operations. W. E. McCreery, sales manager of the Norfolk division, will hereafter report to the general sales manager. C. S. Stackpole, formerly of the sales department of the Norfolk division, will succeed Mr. Riegel as sales manager of the Richmond division and will report to the general sales manager. O. W. Morton, formerly assistant to the vice-president of the Norfolk division, will become sales manager for Norfolk, reporting to the sales manager of the Norfolk division. E. H. Hill, formerly assistant superintendent of the electric department of the Norfolk division, will succeed Mr. Morton as assistant to the vice-president of the Norfolk division. W. P. Venable, of the electric department at Fredericksburg, will become assistant superintendent of the electric department of the Norfolk division, and E. F. Turner will become superintendent at Fredericksburg, succeeding Mr. Venable.

M. E. Skinner Now in Albany

M. E. Skinner, who has been commercial manager of the Duquesne Light Company, Pittsburgh, since the spring of 1924, has resigned to join the staff of the Mohawk & Hudson Power Corporation, Albany, N. Y., in general charge

M. E. SKINNER

of the sales and commercial activities. Mr. Skinner brings to his new position a broad background in engineering experience, having been identified with both the manufacturing and the light and power branches of the electrical industry. A native of Madison, Wis., and a graduate of the University of Wisconsin, he entered upon his career with the Westinghouse Electric & Manufacturing Company as a graduate apprentice. During his connection with the Westinghouse company his chief duties were in the field of design engineering with special attention devoted to static induction apparatus.

In 1922 he affiliated himself with the Duquesne Light Company as assistant to the general manager and one year later was promoted to be assistant to the vice-president. It was in 1924 that he became commercial manager in charge of all new-business and commercial activities.

Mr. Skinner is a member and has taken active part in A.I.E.E. work, having served as national chairman of the membership committee and chairman of the Pittsburgh Section. He has contributed a number of articles to the technical press, including several papers presented before the A.I.E.E. He is a member at large of the executive committee of the Commercial Section of the National Electric Light Association and has been actively engaged in the work of the Pennsylvania Electric Association, having served as chairman of the Commercial Section, then treasurer, and being at the present time a member of the executive committee, with the office of vice-president of the association.

Fred D. Corey of Buffalo has been elected president of the Western New York Utilities Company, Inc., Batavia, N. Y., to succeed Walter C. Lewis of Boston, who has disposed of his holdings. Mr. Corey is also president of the Niagara, Lockport & Ontario Power Company and is chairman of the executive committee of the Niagara, Buffalo & Eastern Power Corporation. **S. Pick** of Buffalo is the new vice-president of the Batavia company and **Charles D. Warren** of Buffalo is secretary. The directors are Paul H. Schoellkopf of Niagara Falls and Fred D. Corey, William R. Huntley and H. L. Mann, all of Buffalo. Mr. Huntley is president of the Buffalo General Electric Company. The Western New York Utilities Company, Inc., has been reorganized, following the sale of the controlling interest to the Buffalo, Niagara & Eastern Power Corporation.

David C. Johnson, formerly manager of the public utilities department of the National City Company, New York, has been elected a vice-president of the New York Steam Corporation.

Ira Steele, formerly commercial manager of the Des Moines (Iowa) Electric Light Company, has been appointed assistant general manager of that company.

Obituary

Charles W. Holtzer

Charles William Holtzer, founder and chairman of the board of the Holtzer-Cabot Electric Company, Boston, died at his home in Brookline, Mass., March 31. Mr. Holtzer was widely known in American electrical manufacturing circles, for he had served the industry for half a century and combined to an

C. W. HOLTZER

unusual degree engineering insight and business ability. He was born in Karlsruhe, Germany, and received his education at the Institute of La Fontaine, at that place. Removing to the United States in 1866, he first carried on certain experimental work in connection with the timing of explosive projectiles and later spent some years in the employ of E. S. Ritchie & Sons of Brookline, makers of scientific instruments. In 1874 he engaged in the manufacture of certain electrical devices in conjunction with a Mr. Newell under the firm name of Holtzer & Newell, a year later establishing a small business of his own still dealing with electrical apparatus.

It was in 1875 that he went into the electrical manufacturing business in Brookline, specializing in communication equipment and contributing to early telephone exchange construction

in that town. Subsequently he formed a partnership with Seth W. Fuller, who was engaged in electrical contracting, and the business was conducted under the name of Seth W. Fuller & Holtzer. When George E. Cabot joined forces with that firm the name was changed to Fuller, Holtzer & Company, but in 1889 that company was dissolved, Mr. Fuller withdrawing and Messrs. Holtzer and Cabot forming the company which today bears their joint names. As is well known, the products of this house were multiplied with the years to include motors, signal equipment and other specialties. The loss of Mr. Holtzer will be keenly felt by his business associates and by his employees, in whose welfare he had deep concern.

Arthur Keller, chief electrical engineer of the Harnischfeger Corporation, died Saturday, March 12, at his home in Milwaukee. He was born in Switzerland in 1882. Mr. Keller had been connected with the Harnischfeger Corporation for the last twenty years and during that time had perfected much of the electrical equipment that goes into its cranes. Mr. Keller was educated at the Universities of Zurich and Bien in Switzerland and was employed by some of the largest electrical manufacturers in this country as well as in Europe before he joined the Harnischfeger Corporation. He was a member of the American Institute of Electrical Engineers and of the Association of Iron and Steel Electrical Engineers.

Charles Dixon, at one time superintendent of the old Merchants' Electric Light Company at Lafayette, Ind., died recently at his home near Rochester, Ind. He retired thirteen years ago because of ill health. Mr. Dixon was 62 years of age.

Walter M. Parker, director of the Public Service Company of New Hampshire, the Manchester Street Railway Company and numerous other public utility and industrial companies in New England, died March 28 of pneumonia, in his seventy-seventh year. Mr. Parker was president of the Manchester National Bank and treasurer of the Manchester Savings Bank.

Jesse M. Smith, consulting engineer, expert in patent litigation and a former president of the American Society of Mechanical Engineers, died at his home in New York April 1. In 1898 Mr. Smith established a consulting engineering practice in New York, which he carried on until 1914, when he retired from an active career. Mr. Smith was born in Newark, Ohio, in 1848 and was educated at the Rensselaer Polytechnic Institute, Troy, N. Y., and at the Ecole Centrale des Arts et Manufactures, Paris. From 1874 to 1880 he engaged in building iron blast furnaces and in coal mines in the Hocking Valley, Ohio, but removed his interests in the latter year to Detroit, where he spent eighteen years as consultant on the design of special machinery and apparatus for electrical and manufacturing plants and as an expert in patent litigation. Mr. Smith was a charter member of the American Institute of Electrical Engineers.

Recent Court Decisions

Court Injunction Frees Company from Conflicting Jurisdiction of Commission. — The United States District Court for the Eastern District of Kentucky has held, in Union Light, Heat & Power Company vs. Kentucky Railroad Commission, that in a case where a utility company was forced by court injunction to continue its service after the expiration of its franchise a statutory provision that if such a company desires to discontinue service it must first obtain authority to do so from the commission has no application. (17 Fed. (2d) 143.)*

Resolution of Council Drawn by Company Must in Doubt Be Construed Against Company. — In an action brought by the Northern Westchester Lighting Company against the Village of Ossining the Appellate Division of the New York Supreme Court held that where the Village Council adopted a resolution written by the utility company, with the intent of simplifying its bookkeeping and not intended to alter the company's franchise, this resolution was, in any case of reasonable doubt, to be construed against the company. The resolution in question had reference to the franchise tax in its relation to free lighting furnished the village by the company under the franchise. (219 N. Y. S. 537.)

Damages Not Recoverable for Cessation of Service on Failure of Customer to Pay Bill.—The Supreme Court of Mississippi, in Thomas vs. Central Louisiana Power Company—a case in which plaintiff refused to pay his monthly power bill on the ground that the company by a temporary cessation of service had damaged him to the extent of $56, and then, when the company shut off his energy, sued for $425 damages—held that the company was justified in the second instance and there could be no damages imposed. As to the $56 originally claimed, this was a legal demand cognizable only in a court of law and not in the chancery court where the plaintiff had obtained an injunction against the discontinuance of service. (111 So. 142.)

Georgia Municipalities May Exact Guarantees for Payment of City-Plant Bills.—That the city of Moultrie, Ga., acted within its legal rights when it passed an ordinance requiring water and light consumers to post a guarantee that their bills would be paid has been held by the Georgia Supreme Court in a suit brought by citizens against the city. These citizens contended that the ordinance was inspired by "landlords, who, in a few instances, had been required to pay water and light bills left unpaid by tenants when they moved." They argued that the city already had ample guarantee that bills for service would be paid.

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Not Concerned with Whether Necessary City Permits Have Been Granted. — The Pennsylvania Superior Court supported the Pennsylvania Public Service Commission in a suit brought against it (Wilson vs. Commission) to invalidate a certificate of convenience and necessity for the construction of a high-tension line over private property on the ground that the commission had failed to consider the question whether the company had obtained the necessary consent of the city to cross public streets with the line in question. The Superior Court held that the commission was not required to consider that issue; that the granting of a certificate determined neither the validity nor the scope of a subsequent proceeding to acquire title to the property, but is evidence merely of the preliminary approval of such proceeding.

Commission Rulings

Credits to Retirement Reserve Fund. —In granting an increase in electric rates to the Peninsular Power Company, the Michigan Public Utilities Commission said that any excess in income over 8 per cent on the rate base should be credited to retirement reserve, in addition to the accrual of 1.5 per cent on the fixed capital. The commission requires this provision to be in effect until the accumulation of the reserve to an amount which in its judgment is ample for the protection of the investment, at which time it will entertain an application for a readjustment of the rate.

Utility Company Not Compelled to Make Sure Customer Is on Most Favorable Schedule.—A complaint alleging a discriminatory practice on the part of the Commonwealth Edison Company in refiguring bills has been dismissed by the Illinois Commerce Commission. The complaint was that customers who had been taking service under the schedules for light and power were found entitled to lower rates resulting from the application of the company's regular rate for large light and power service and that the company refigured the bills for two months prior to the date of the change of contract, while other consumers changing from rates for light and power to rates for limited-hour service were found not entitled to change except at the beginning of a peak period or during a peak period, when their bills were refigured on the new basis only to the date of the contract. The commission held that there was ample justification for this distinction. The complaint also alleged that some consumers were notified of their right to change sooner than others, but the commission held that the company was not always able to ascertain when a particular customer would be entitled to the benefit of the lower schedule and pointed out that it had consistently held that there is no obligation on the utility whereby it must assure itself that at all times customers are on the most favorable schedules.

Financial and Statistical

Utility Stocks Appreciate Slowly Bond Averages Unchanged

THE fact that power and light stocks as a group have not taken much part in the recent upswing in which many industrials and rails have established new high points should not obscure the fact that a steady gain has been made in utility averages.

As pointed out by an investment authority, the hesitancy of utility issues to swing in line with any speculative movement that happens to start is an indication of soundness and stability rather than the reverse. This, of course, has already been proved in market breaks in the past, when utility issues have invariably reacted less severely than other market groups.

Not much change has taken place in the bond market during the week. Averages remain about the same. The ELECTRICAL WORLD index number of power and light bonds remains at 102.7, the same figure as for last week. This compares with a high of 103 two weeks ago and 101.3 at the beginning of 1927.

National Public Service Will Be Operated as Unit

Great interest is being manifested in banking and public utility circles over the National Public Service Corporation, formerly controlled by A. E. Fitkin and operated by the General Engineering & Management Corporation, but now owned by E. H. Rollins & Sons, Howe, Snow & Bertles, Inc., and Day & Zimmermann and operated by Day & Zimmermann. The Fitkin organization in New York is being gradually disbanded, resulting in considerable saving in overhead, and there has been a drastic cut of many millions in the budgets for expansion.

It is generally understood that the present owners will operate on very conservative lines and build up property and equity by plowing back earnings for a few years at least. There appears to be no inclination to split up the National Public Service Corporation into smaller groups and to dispose of some of the companies, notwithstanding many very tempting offers from other public utility operators. The disposition is rather to hold and strengthen the existing properties and not to add others for the present.

Middle West Utilities Stock Plan Ratified

Stockholders of the Middle West Utilities Company on March 29 approved an amendment to the company's charter of incorporation providing for the creation of no-par preferred and prior-lien stocks in addition to the present prior-lien and preferred stocks of $100 par value. The no-par prior-lien stocks were authorized for issuance in seven series varying in interest rates from $5 to $8. Two hundred and fifty thousand shares of prior-lien stock without par value and 250,000 shares of preferred stock without par value were authorized. The amendment also increases the authorized prior-lien and preferred stocks of $100 par value from $50,000,000 each to $70,000,000 each.

Some Aspects of Depreciation Rates—I

An Examination of the Application of the Insurance Concept of Life Tables to Utility Property Depreciation

BY JAMES D. MORTIMER

MANY of those who have searched for experience data on the lives of elements of utility property will sympathize with the intent of the editorial on the subject published in the Nov. 20 issue of the ELECTRICAL WORLD. At least two large utilities have notations running back fifteen years on the ages of items of property retired during that period. They afford a wealth of figures for any one inclined to reduce them. At one time the assembly and interpretation of such information seemed to be a subject for the national associations or some divisions thereof. Much water will flow over the dam before "depreciation" or retirement tables that will be of significance for future use will be evolved from experience data. Even if records were complete, there would be no reasonable expectation that such life data could be applied to the future on any basis other than that of tentative computations. There may thus be more real objections to the indiscriminate use of such data than that of prejudice.

J. D. MORTIMER

JAMES D. MORTIMER *is one of the outstanding men in the public utility business. When S. Z. Mitchell left the Northwest to form the Electric Bond & Share Company he brought Mr. Mortimer with him and he became successively engineer, manager of the operating department and vice-president. In 1911 the late James Campbell induced Mr. Mortimer to join the staff of the North American Company, of which in 1914, when he was 35 years old, he became president. Mr. Mortimer, then one of the youngest executives in the business and full of enterprise and enthusiasm, was largely instrumental in making light and power the company's main interest. He was an early advocate of the indeterminate permit and was one of the first operators in this country to adopt pulverized fuel. He resigned from the North American Company in 1920 and is at present specializing in public utility reorganizations and investment securities in New York.*

Let us consider for a moment the points of view to be met. They are:

1. Courts, commissions and people generally hold that new physical property has a greater present value than when some years of life have elapsed. It is conceivable that there might be a distinction between the kind of value to be used in purchase and sale and the measure of capital to be used for testing the reasonableness of annual returns resulting from the application of rate schedules. There might also be a difference between the problem of appraising "accrued depreciation" and the concurrent reserve to finance retirement.

2. Some utility operators hold that there is no diminution in "service value" with passing years so long as there is "adequate maintenance." To admit a diminution in "service value" would entail the necessity of accruing a reserve, and the measure of capital for rate making might thus be reduced. In the extreme case no annual charge to earnings is made on account of such reserve and retirements are charged off when, as and if completed.

3. Some commissions and some operators maintain the desirability of charging each year's earnings with an equal proportion of the original cost of the property, the annual installments being determined by the probable life viewed from age 0—"straight-line" accruals from assumed "life tables." Naturally enough, the operators argue for a "service value" for rate making without deduction of the accruals. Thus the Interstate Commerce Commission

TABLE I—RETIREMENT TABLES A AND B*
(Condensed)

Age Groups	Per Cent of Original Living at Beginning of Each Age Group A	Per Cent of Original Living at Beginning of Each Age Group B	Complete Expectation of Life: Years Beginning of Each Age Group A	Complete Expectation of Life: Years Beginning of Each Age Group B
0– 4	100.00	100.00	25.45	24.00
5– 9	99.59	93.48	20.51	20.67
10–14	97.48	85.00	15.92	17.33
15–19	90.68	76.39	11.90	14.00
20–24	75.52	66.70	8.74	10.87
25–29	52.52	55.15	6.46	7.33
30–34	28.62	40.88	4.75	4.00
35–39	11.52	16.89	3.41	0.67
40–44	3.07	0	1.98	0

TABLE II—ANNUITY AND ANNUAL PREMIUM VALUES
(Retirement Tables A and B, Condensed)

Year	Ax† Annuity Values A	Ax† Annuity Values B	Px† Annual Premiums Payable First of Year A	Px† Annual Premiums Payable First of Year B
0	15.16	14.13	0.0234	0.0280
5	13.10	12.83	0.0325	0.0338
10	10.77	11.42	0.0468	0.0420
15	8.50	9.79	0.0668	0.0542
20	6.49	7.90	0.0951	0.0739
25	4.87	5.68	0.1318	0.1110
30	3.66	3.10	0.1760	0.2055
35	2.61	0	0.2391	.....
40	1.74	.....	0.3700	.....

* "A" contemplates rapid retirement between ages 15 and 34. When expectation and years age are plotted, "A" is substantially a straight line from age 28 to 46 and gently curving at all lower ages, and crosses "B," a straight line, once at about age 5 and a second time at about age 29.5.

† Ax is the then present value at any age of the future payment of $1 at the end of each year the unit remains in service. Px is the amount that must be paid at the beginning of each year the unit is in service in order to provide $1 at the end of the year in which the unit is retired. Px thus corresponds to the annual installments of a sinking fund in which the first installment begins at the beginning of the period. The relation between Ax and Px does not depend on the retirement table. Example: Using Table B, a property of similar units having an "expectation" at age 0 of 24 years could be insured with an annual contribution of 0.0280 per dollar of cost if started at age 0; if started at age 10, the annual contribution would be increased to 0.0420.

The lower ranges of Table B may be used for units initially having a shorter probable life than 24 years, and the table may be extended beyond 0_{24} to embrace units having an initial expectation of more than 24 years.

and some of the telephone interests were in agreement up to a certain point (I.C.C. opinion Nov. 2, 1926) and then diverged.

4. Another group of commissions and operators agree with "group 3" about the desirability of charging each year's earnings with some portion of the cost of future retirements, but maintain that the accrued amounts should carry interest at rates varying from 2 to 6 per cent and the measure of capital for rate-making tests approximate the original cost or present reproduction cost new. This group splits into several branches, depending on previous culture and objectives to be attained.

It would be wholly useless to indicate possible errors in viewpoint of one or the other group, if any exist; whatever the conclusion, the intention may well be presumed to be meritorious. It is a much more fascinating problem to show how the ideas of the several groups can be reduced to a common denominator or fundamental concept and qualitatively indicate the variations therefrom. The problem is one of synthesis rather than one of analysis. At the outset certain limitations which help define the problem are met.

(a) "Life tables" are indicative only; straight rails usually last longer than ties that support them; cars live longer than motors; conduits live longer than cables, and dams may last longer than waterwheel runners or guide vanes. Past history, even if known, carries no facts appertaining to the future. Experience data show a wide range of values of useful lives in service of the same kind of property apparently operating under similar conditions.

(b) The causes that eventually lead to retirement of units of physical property may be divided into two classes—one, chance retirement equally likely to occur to the young or the old units, and the other, an increasing disability to withstand retirement. The same two classes of causes appear in the make-up of the human life tables and give rise to Makeham's formula $x = ks^x(g)^{c^x}$ where x = number living at age x out of an original number of entrants, and k, s, g and c are constants derived from experience data and highly entertaining to those who find pleasure in solving four simultaneous logarithmic equations.

(c) Only in the event that interest is illegal or otherwise prohibited, can sums of money paid or which become due at different times be added together arithmetically to produce a significant sum. Interest shall be allowed for in accumulating annual installments of the successive contributions to the reserve to insure the integrity of capital on abandonment and in appraising the present values of future liabilities.

Lacking data concerning the future and lacking gifts of prophecy, we face the problem of accumulating definate sums, any one or more of which may become due at future times. Thus stated, the annual contribution appears indeterminate. It is indeterminate so far as any individual item is concerned; it becomes more determinate only for the group as a whole. It may be made completely determinate over a period of years for such a group by assuming a schedule under which the sums become due and correcting the net rate

TABLE III—POLICY VALUES OR RESERVES
(Retirement Table B, Condensed)

Year	Policy Value or Reserve—Premium 0.0280 Beginning at Age 0	Policy Value or Reserve—Premium 0.0352, Beginning at Age 6
0	0	0
6	0.1034	0
11	0.1980	0.1068
16	0.3105	0.2309
21	0.4391	0.3750
26	0.5899	0.5432
31	0.7660	0.7660
34	0.8880	0.8760

of accumulation for the individual successive years in accordance with the extent of the successive departures from the assumed schedule. This is the practice of life insurance, in which the net premium for a given insurance at a given age is computed on the basis of an assumed mortality table and interest rate, loaded for commissions and expenses to produce actual premium, and in later years reduced by "dividends" arising from credits on account of lower actual mortality rates, higher interest returns on reserve balances and lower overhead expenses; liabilities are measured by the original schedule and specified in many instances by law.

In point of fact the retirement table used in physical property computations does not make much difference except that the annual premiums (annual reserve credits) should be subject to a minimum amount of correction. Errors in assumptions are corrected from year to year, and eventually more reliable retirement tables result, by the use of which the premiums will involve minimum corrections and reserves will be more accurate. If an unlimited life is assumed, as in assessment insurance, or as unconsciously by group 2, the annual reserve credits are all corrections. The more closely the assumed retirements fit to the ensuing experience, the more accurate the computation of "policy values" or reserve balances.

If the interest rate on reserve balances is reduced to zero per cent, the rate of accumulation from premiums must be increased by the equivalent of the interest not credited and we have "straight-line" accumulation. If accumulations be deferred until the property has attained some appreciable age, the annual accumulations or premiums must be larger, since the retirements will be greater in number in successive years and the accumulations from interest on reserve balances will be smaller.

Since a synthetic combination of several diverse points of view is being sketched, it may well be illustrated by examples. There have been constructed two assumed retirement tables in the same form as human mortality tables:

Table A where the frequency of abandonment approximates the statistical curve of "normal distribution," spread over a total age of 45 years and having a "complete expectation" at age 0 of 25.45 years.

Table B where "complete expectation" is assumed to decline proportionately with equal increments in age, spread over a total age of 36 years and having a "complete expectation" of 24 years at age 0.

In condensed summary comparative table, they are given as Table I.

Next follows the computation of the annuity values for the different years. A_x with interest at 4 per cent is given in comparative summary form in Table II.

Before concluding this brief reference to the application of contingencies, there will be shown the comparative reserve values under retirement table B when reserve credits or premiums begin at age 0 and when postponed until the beginning of year 6. The reserve values represent the fractional

dollars per dollar of original cost of unit the capital value of which is to be insured; they measure the difference in present values of the insured sum and the premiums to be paid in the future.

Expansion in Germany

Vast Increase in the Industrial Uses of Electrical Energy Is Shown by Census of July, 1925

A RECENTLY published report on the German Industrial Census of July, 1925, shows a great increase in the use of electrical power at the expense of other kinds. The last census of this nature was in 1907. It showed electric motors in the whole empire in industry of all kinds (exclusive of agriculture) aggregating 1,691,646 hp., as against 6,945,193 hp. of steam and other mechanical power. Corrected to the present national area, these figures are 1,522,618 hp. and 6,223,458 hp. respectively. The census of July, 1925, shows an increase for electricity to 11,625,303 hp., or 663.5 per cent, as compared with 1907 (present area), while other forms of power have fallen to 6,031,357 hp., or 97 per cent of the former installation. The change in leading branches of industry is shown in the table. In the rubber industry the horsepower of electric motors in use increased 1,300 per cent. Increases of between 400 and 1,000 per cent are shown in other branches.

The electrotechnical industry is increasingly prosperous and presents a strong contrast with the engineering and machine-construction branches, which have so far benefited very little from the general trade revival. The leading electrical corporations' reports for the business year 1925-26 show increased profits and dividends and are accompanied by optimistic statements from authoritative persons as to the outlook.

ILLUSTRATED BY POSITION OF COMPANIES

Net profits of the General Electricity Company (Allgemeine Elektrizitäts A. G.) are returned at 10,302,620 marks, as against 7,986,385 marks in 1924-25. Dividend on the common stock is 7 per cent against 6 per cent, and dividends on the two classes of preferred stock remain unchanged at 6 and 5 per cent respectively. The report states that "the duration and steadiness of the improvement indicate that it is not due to any temporary stimulus such as the English coal strike."

The Siemens corporations' reports are even more satisfactory. The Siemens & Halske Company returns net profits of 15,350,000 marks, as against 8,890,000 marks in 1924-25, and has increased its dividend from 6 to 10 per cent. Siemens-Schuckert's net profit is 12,170,000 marks, against 8,950,000 marks, and the dividend is 8¼ per cent against 6. Net profits of the Elektrizitäts A. G. (formerly Schuckert & Company) are 3,616,000 marks, against 1,979,000 marks, and the dividend is 7 per cent against 4. As compared with the business year 1923-24 (the first year operated under stable currency conditions), the progress is enormous. Gross profits of Siemens & Halske have increased fivefold, net profits about sixfold.

The government is preparing a bill regulating on homogeneous lines the production and use of electricity throughout the whole republic. The Ministry of Industry lately initiated an inquiry for the purpose of obtaining data for this purpose. The Prussian Cabinet has prepared a measure transferring all the large state electrical interests to a single corporation, as was done three years ago with the Prussian state mines. Prussia owns all of the stock of the Oberweser Kraftwerke of Cassel and the Hannover Grosskraftwerke, and it owns between 9 and 80 per cent of the stock in a dozen other overland and other power corporations. The measure referred to has as its aim the complete separation of state property from the general state financial interests, a policy pursued also by the republic when it united its large industrial interests in the big "Viag" corporation.

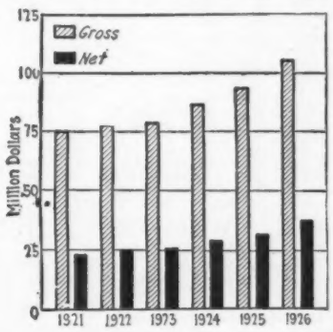
GROWTH OF USE OF ELECTRICITY IN GERMAN INDUSTRIES

	1907 (Present Area)		1925	
	Electricity, Hp.	Other, Hp.	Electricity, Hp.	Other, Hp.
Mining	244,903	1,104,673	1,672,915	1,416,750
Metallurgical	239,812	903,239	1,545,707	525,290
Engineering and vehicles	173,087	340,078	1,271,169	164,105
Electrical	50,411	53,377	439,490	13,220
Chemicals	72,651	212,727	684,051	264,362
Paper	120,279	426,326	610,855	366,360
Textiles	96,305	816,686	706,257	572,811

Public Service of New Jersey Further Simplifies Structure

RETIREMENT of a number of outstanding security issues by the Public Service Corporation of New Jersey marks further progress in the simplification of this company's capital set-up. Eight individual bond issues were acquired during 1926 by sinking funds provided for under the mortgages; a general mortgage issue for $1,454,000 was called for payment, and three other issues were retired. Since the beginning of the current year further steps have been taken in this simplification process.

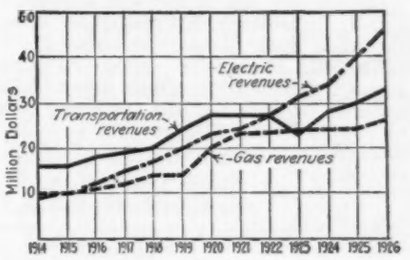
In other respects the period covered by the annual report just issued was one of progress. Gross operating revenue of subsidiary companies increased 12 per cent and operating income almost 10 per cent. Operating expenses,



PUBLIC SERVICE SHOWS STEADY GROWTH IN VOLUME OF BUSINESS

maintenance and taxes all increased materially, the latter being 14 per cent larger last year than in 1925.

The volume of business in actual kilowatt-hours sold showed an increase of almost 19 per cent during the year and has more than doubled in the past four years. Gas and transport business also increased, but to a less marked extent.



ELECTRIC REVENUES HAVE SHOWN LARGEST INCREASE

Public Service has added greatly to its real property holdings during the past year or so. Acquisitions include city real estate, substation sites and transmission-line right-of-way.

Ontario Hydro Reports New Output Records

The ninth annual report of the Ontario Hydro-Electric Power Commission, which was presented to the Legislature of the province on March 28, states that power development has been increased from 808,398 hp. to 928,032 hp., the latter figure being the highest ever attained. The revenue from consumers reached a total of $20,555,179, which was sufficient to meet fixed charges, provide $4,295,894 for sinking fund, etc., and leave a surplus of $565,413. The report showed a notable increase in the number of rural transmission lines, 750 miles having been added during the year. The total rural mileage is now 2,300 miles. The number of rural customers is 19,000 and investment in rural lines totaled $4,750,000, revenue from this source being $743,133.

The total of the public investment in the system amounted to $203,442,759, of which $155,769,665 is invested in the Niagara Falls system. The increase in power during the year occurred almost entirely in that system, which generated 800,000 hp. in comparison with 683,646 hp. last year.

New Capital Issues

Cumulative preferred stock of the Queens Borough Gas & Electric Company, bearing interest at the rate of 6 per cent, was offered the investing public during the first week of April at par and dividend. This piece of financing involved a total of $4,450,000. Proceeds will provide funds for the retirement of 8 per cent cumulative preferred stock outstanding to the amount of $2,450,000 and for additions, extensions and improvements to the properties of the company.

A three-million-dollar offering was made by the Mississippi River Power Company in the form of 5 per cent debentures priced at 96¼ to yield 5.30 per cent. Proceeds of these debentures, to be due May 1, 1947, will be used for the redemption of the company's fifteen-year 7 per cent sinking-fund gold debentures, of which $2,473,000 principal amount is now outstanding, and for other corporate purposes.

The Central Gas & Electric Company issued first-lien collateral-trust sinking-fund gold bonds, amounting to $2,300,000, the price being 95 and accrued interest, to yield about 5.95 per cent. Funds derived from the sale of these bonds will be used in the acquisition of new properties, for the retirement of $787,000 of divisional bonds, for additional property improvements and for other corporate purposes.

The Texas-Louisiana Power Company issued fifteen-year 6 per cent sinking-fund debenture gold bonds, series A, to the amount of $1,400,000, the price being 96½ and accrued interest, to yield over 6.35 per cent. First and refunding mortgage 5 per cent gold bonds of the Illinois Northern Utilities Company, priced at 97½ and interest, were also offered during the week under review, an issue totaling $1,250,000. These bonds, yielding over 5.15 per cent, mature April 1, 1957.

Southern California Stockholders Offered Additional Shares.—The Southern California Edison Company has been authorized by the State Railroad Commission to sell $10,000,000 of series D 6 per cent preferred and $4,268,300 common, both to be sold at not below $25 par. The issue of common is to be offered to holders of the original preferred and common stock at par in the ratio of one share for twelve shares of their present holdings.

Company Reports

Name of Company	Gross Earnings Twelve Months Ended Feb. 28 1927	1926
American Gas & Electric	$73,537,032	$67,002,711
American Power & Light	60,572,309	52,732,477
Baton Rouge Electric	980,306	827,149
Blackstone Valley Gas & El.	5,600,686	5,140,436
Cape Breton Electric	628,398	564,094
Edison Elec. Illg., Brockton	1,716,638	1,676,270
Electric Light & Power Co. of Abington & Rockland	584,683	551,525
El Paso Electric	2,872,333	2,594,531
Galveston-Houston Electric	4,740,485	3,954,211
Lowell Electric Light	1,738,560	1,645,384
New Bedford Gas & Ed. Lt.	4,198,807	3,991,080
Northern Texas Electric	2,536,280	2,445,084
Puget Sound Power & Light	13,735,428	12,949,267
Savannah Electric & Power	2,241,373	2,010,792
Sierra Pacific Electric	1,267,874	1,136,773

North American Company Changes Par Value of Stock.—Stockholders of the North American Company will vote April 25 on changing the authorized common stock from $60,000,000 (par $10) to 10,000,000 shares of no par value and increasing the authorized 6 per cent cumulative preferred stock from $60,000,000 (par $50) to $100,000,000 (par $50). According to a statement made by F. L. Dame, president, since the change was to be submitted to the stockholders for approval it was deemed expedient to submit to them at the same time a proposal to

Stock Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday April 5	Low 1927	High 1927
ABITIBI PWR. & PAPER, 4% com.—no par	91	83	93
Adirondack Pwr. & Lt.—7% pf.	106	107	109½
Adirondack Pwr. & Lt.—8% pf.	111	112	114
Ala. Pwr., 7% pf.	111	107	112½
Allis-Chalmers Mfg., 7% pf.	110	109	111½
Allis-Chalmers Mfg., 6% com.	100½	110	100½
Aluminum Co. of Amer., com.	67	69½	73
Aluminum Co. of Amer., 6% of.	102	101½	103
Amer. & Foreign Pwr., pf. 25% pd.	m110	....	2
Amer. & Foreign Pwr., 7% pf.—no par	94½	86½	95
Amer. & Foreign Pwr., com.—no par.	24	18½	25½
Amer. Bosch Magneto, com.—no par	15½	13	18½
Amer. Brown Boveri Elec†	23½	21	39½
Amer. Brown Boveri Elec., pf. $7	k86	85	98
Amer. Gas & Elec., 6% pf.—no par	101	95½	101
Amer. Gas & Elec., com.†—no par	73½	68½	100½
Amer. Lt. & Trac., 6% pf.	120	112	120
Amer. Lt. & Trac., com.†	230	222	235
Amer. Pwr. & Lt., 6% pf.	99	97½	101
Amer. Pwr. & Lt., com.†—no par	57½	54	61½
Amer. Pub. Serv., 7% pf.	k 98	95	99½
Amer. Pub. Serv., com.†	50	....	....
Amer. Pub. Utilities, 7% pr. pf.	92	88	92
Amer. Pub. Utilities, 7% ptc. pf.	73	73	82
Amer. Pub. Utilities, com	m66	65	70
Amer. States Sec., A	3	3½	4½
Amer. States Sec., B	3	3	4½
Amer. Superpwr., $6 pf.—25	k 28	26½	28½
Amer. Superpwr., 7% pf.	f 96	....	....
Amer. Superpwr., Class A†—no par	29½	27½	30
Amer. Superpwr., Class B†—no par	30½	28½	31½
Amer. Wtr. Wks. & Elec., 7% pf.	k108½	104½	110½
Amer. W. W. & E., com. $1.20—20	79½	62½	79½
Anaconda Copper cap. $3	46½	45	49½
Appalachian Electric Pwr., 7% pf.	101	100	102
Appalachian Elec. Pwr., 2d pf., 7%	100	100	102
Appalachian Elec. Pwr., com.	m78	....	....
Arizona Pwr., 7% pf.	79	77	84½
Arizona Pwr., com.	23	....	....
Arkansas Cent. Pwr., pf.—$7 no par.	k102	101	103
Arkansas Lt. & Pwr., 7% pf.	102½	101	104
Arkansas Lt. & Pwr., com.	100	....	....
Assoc. Gas & Elec., $3.50—50	50½	....	....
Assoc Gas & Elec., pf.—$6—no par	88	85	90
Assoc. G.&E., Class A, $2.50—no par	41	35	42
BABCOCK & WILCOX, 7% com.	119½	115½	124
Binghamton L., H. & P., $6 pf.	93	93	95
Birmingham Elec., pf.—$7—no par.	107	105	109
Blackstone Valley G. & E., $6 pf.	103	103	105
Blackstone Valley Gas & Elec., 10% com.—50	k108	98	101
Blaw-Knox, com.†	f 72	70	73
Brazilian Trac., Lt. & pwr., com.†	f133	....	....
Broad River Pwr., 7% pf.	100	97	100
Brooklyn Edison, 8% com.	156	145½	159½
Buffalo, Niagara & East. Pwr., pf.—25	f 25½	....	....
Buffalo, Niagara & East. Pwr. com.† —no par	f 28½	....	....
CALIFORNIA ELEC. GENERATING, 6% pf.	97	96	98
California Ry. & Pwr., 7% pf.	130	125	150
Carolina Pwr. & Lt., pf.—$7—no par	l107½	107	108½
Central & S.W. Util., 7% pf.—no par	a 95½	93½	96½
Central & S. W. Util., pr. ln. $7 pf. —no par	a99½	98½	101½
Central Ariz. Lt. & Pwr., 7% pf.	l100	100	100
Central Ark. Ry. & Lt., 7% pf.	100	100	102
Central Ill. Pub. Serv., 6% pf.	a 90	....	....
Central Ind. Pwr., 7% pf.	88	86	90
Central Pwr. & Lt., 7% pf.	101	100½	103
Central States Elec., 7% pf.	93	93	96
Central States Elec., com.†	m200	....	....
Century Elec., 6% com.	m115	115	115
Chicago Fuse Mfg., com.—$2.50 no par	a 34	30	34½
Cincinnati Gas & Elec., 5% com.	q 95½	....	....
Cities Service, 6% pf.	l 90	87	92½
Cities Service, pf. B—10	k 8½	7½	8½
Cities Service, pf. BB—100	l 81	81	85½
Cities Service, com.—20	l 51½	40½	58½
Cities Service, Bks. Shrs.—10	h 25½	25½	29½
Clarion River Pwr., 8% pf.	95	....	....
Cleveland Elec. Illg., 6% pf.	108	108	109½
Cleveland Elec. Illg., 10% com.	300	302	310
Colorado Pwr., 7% pf.	k 95	95	97½
Columbia Gas & Elec., 6% pf.	104½	99½	105½
Columbia G. & E. com. $5—no par	88½	82½	91½
Columbia Ry., Gas & Elec., 6% pf.	94	....	....
Columbus Elec. & Pwr., 2d. pf.	103	....	....
Columbus Elec. & Pwr., 9% com.	66½	....	....
Columbus Ry., Pwr. & Lt., 6% 1st pf.	99	98½	99½
Columbus Ry., Pwr. & Lt., 6½% pf. B	99	96	99
Columbus Ry., P. & L., com.—no par	70	75	79
Commonwealth Edison, 8% com.	a144½	....	....
Commonwealth Pwr., 6% pf.	96½	91½	97
Commonw'th Pwr., $2, com.—no par	46	42½	48
Conn. Lt. & Pwr., 8% pf.	120	119	123
Conn. Lt. & Pwr., 7% pf.	113	112	113½
Cons. Gas of N. Y., pf.†—50	56	55½	62
Cons. Gas of N. Y., com $5—no par	99	94	109½
Cons. Gas, Elec. Lt. & Pwr. of Balti., 6% pf.	e107½	106½	107½
Cons. Gas, Elec. Lt. & Pwr. of Balti., 6½% pf.	e112	111	112½
Cons. Gas, Elec. Lt. & Pwr. of Balti., 7% pf.	e114	....	....
Cons. Gas, Elec. Lt. & Pwr. of Balti., 8% pf.	e127½	....	....
Cons. Gas, Elec. Lt. & Pwr. of Balti., com. $2.50—no par	e 54½	....	....
Consolidated Pwr. & Lt., 7% pf.	100	100	103
Consumers Pwr., 6% pf.	102½	100	102
Consumers Pwr., 6.6% pf.	105	103	105½
Continental Gas & Elec., 7% ptc. pf.	104	103	106½
Continental Gas & Elec., 7% pr. pf.	102½	100	103
Conti. G. & E. com. $4.40—no par	k220	210	225
Crocker Wheeler, com.†	32	26	37½
Crocker Wheeler, 7% pf.	78	78	88
DALLAS PWR. & LT., 7% pf.	108	107	109½
Dayton Pwr. & Lt., 6% pf.	102	101	103
Detroit Edison, 8% com.	139½	133½	140½
Dubilier Condenser, com.—no par	4½	3½	5½
Dubuque Elec., 6% pf.	108	93	105
Duquesne Lt., 7% pf.	k115½	114½	116½
EASTERN NEW YORK UTIL., $7 pf.	103	102	104½
Eastern New York Util. com.	65	70	75
Eastern States Pwr., $7, com.	11	11	13
Eastern States Pwr., pf.	92	93	95
East. Tex. Elec., 7% pf.	106	106	108
East. Tex. Elec., com. $5—no par	90	....	....
Edison Elec. of Boston, 12% com.	k243½	....	....
El Paso Elec., com. $5—no par	70	....	....
El Paso Elec., 7% pf.	106	105	107½
Elec. Bond & Share, 6% pf.	l106½	105½	109
Elec. Bd. & Sh. Sec., com. $1—no par	l 67½	67½	72½
Electric Household Util.†	a 12½	....	....
Elec. Investors, 6% pf.—no par	93	92	94
Elec. Investors, com.†—no par	34½	32½	37
Elec. Investors, 10% pd. receipts	15	....	....
Elec. Pwr. & Lt., ctfs. pf.	99½	96	100
Elec. Pwr. & Lt., ctfs., 40% pd.	k107½	103½	107½
Elec. Pwr. & Lt., ctfs. full pd.	k107½	....	....
Elec. Pwr. & Lt., ctfs., com.—no par.	18½	16½	20½
Elec. Refrig. cap.†	26	24½	37½
Elec. Ry. Securities, com.—no par.	8	5½	8
Elec. St. Battery com. $5.25—no par	70½	68½	70½
Elmira Wtr., Lt. & R.R., 7% pf.	100½	99	101½
Emerson Elec., pf.	m105	....	....
Empire Pwr., A $6	35	....	....
Engr. Pub. Serv., $7 pf.—no par	101	93½	101
Engr. Pub. Serv., com.—no par	25½	21½	26½
Eureka Vacuum Cleaner, com. $4—no par	70	60½	72½
FAIRBANKS MORSE, 7% pf.	k110	107½	112
F.-M., com.—$2.60—no par	41	38½	42½
Federal Lt. & Trac., com.†	41½	37½	44½
Federal Lt. & Trac., 6% pf.	96½	91½	99½
Ft. Worth Pwr. & Lt., 7% pf.	l110	108	112
GALVESTON-HOUSTON ELEC. 6% pf.	71	68	72
Galveston-Houston Elec., com.	26	28	30
Gen. Elec., 8% com.	90½	81	90½
Gen. Elec., special—10	11½	11½	11½
Gen. Gas & Elec. (Del.) com. A, $1.50—no par	40½	34	47½
Gen. G.&E. (Del.) com. B—no par	m38½	39	43½
Gen. G.&E. (Del.) pf. A, $8—no par.	k113½	113½	115½
Gen. G.&E. (Del.) pf. A $7—no par.	k99½	100	107½
Gen. G.&E. (Del.) pf. B $7	k99	96	99½
Gen. Pub. Serv., $7 pf.	k103	102	106
Gen. Pub. Serv., com.	k12½	11½	14½
Ga. Lt., Pwr. & Rys., 6% pf.	86	87	92
Ga. Lt., Pwr., & Rys., com.	m 60	....	....
Ga. Ry. & Pwr., 8% pf.	k122	119	123
Ga. Ry. & Pwr., 7% pf.	112	106	110
Ga. Ry. & Pwr., 4% pf.	m119	....	....
Ga. Ry. & Pwr., 4% com.	120	....	....
Gt. Western Pwr., 7% pf.	k103	....	....
IDAHO PWR., 7% pf.	103	103	105
Ill. No. Utilities, 6% pf.	k 88	88	92
Ill. Pwr. & Lt., 7% pf.	100	99	101
Ingersoll Rand com. $8	95½	92	95½
Int. Combus. Engr., com. $2—no par	52½	43½	64
Int. Util., Class A—$3.50—no par.	34	28	35½
Int. Utilities, Class B—no par.	k4	2	5½
Interstate Pwr., pf.—$7—no par.	94	93	97
Interstate Pub. Serv., 7% pf.	99	98	99½
Iowa Ry. & Lt., 7% pf.	98	97	99
JERSEY CENTRAL PWR. & LT., 7% pf.	98	97½	98½
Jersey Cent. Pwr. & Lt., 7% ptc. pf.	k115	111	115
Jersey Cen. Pwr. & Lt., com.—no par	k 25	....	....
Johns-Manville, com.†—no par	66½	55½	73½

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid price Saturday, April 2. lBid price Wednesday, April 6. mLatest quotations available. †Dividend rate variable.

Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday April 5	Low 1927	High 1927
KANSAS CITY PWR. & LT. pf.$7	k112¼	112	114¼
Kansas Gas & Elec., 7% pf.	i105	103	104
Kentucky Hydro-Elec., 7% pf.	k95½	94½	97½
Kentucky Sec.,6% pf.	86	83	87
Kentucky Sec., 5% com.	107	110	115
Kentucky Utilities, 6% pf.	96	95	96½
Keystone Pwr. & Lt., 7% pf.	97½	96	98½
LACLEDE GAS LT., 8% com.	182	173½	189½
Lehigh Pwr. Sec., com.—no par.	20	15½	19½
Long Island Ltg., 7% pf.	109	107	109
Long Island Ltg., com. $2—no par.	140	139	153
Los Angeles Gas & Elec., 6% pf.	99	98	100½
Louisville Gas & Elec., cl. A. $1.75	26½	23½	27½
MAN. ELEC. SUPPLY, cap. $4.25—no par.	64½	53½	72
Manila Elec., com.†—no par.	k44½	40	46
Maytag Mfg., com. .50—no par.	28½	23½	28½
Memphis P. & L., pf.—$7—no par	108½	107	109
Metropolitan Ed., pf.—$6—no par.	96½	93	97
Metropolitan Ed., pf.—$7—no par.	103½	104	108
Metropolitan Ed., com. $5—no par.	67	....	....
Middle West Utilities, 7% pf.	a107½	....	....
Middle West Util., 7% pr. lien pf.	a118	....	....
Middle West Util., com. $6—no par	a108½	....	....
Midland Utilities, pr. ln. 7% pf.	a102	....	....
Midland Utilities, 7% pf. A	a 98	....	....
Milwaukee Elec. Ry. & Lt., 7% pf.	k101	100	103
Milwaukee Elec. Ry. & Lt., 6% pf.	k99½	98	101
Minn. Pwr. & Lt., 7% pf.	i105½	104	105
Miss. Pwr. & Lt., $8 pf.	109	106	111
Miss. River Pwr., 6% pf.	98	94	97
Miss. River Pwr., com.	62	....	....
Mohawk Hudson Pwr., 1st pf.—$7—no par.	103	100	104
Mohawk Hudson Pwr., 2d pf.—$7—no par.	100	98	101½
Mohawk Hudson Pwr., com.—no par	k24½	20½	27
Montana Pwr., 7% pf.	123	118½	123
Montana Pwr., 4% com.	96½	81½	96½
Montreal Pwr., 7% com.	f 78½	....	....
Mountain States Pwr., 7% pf.	99	97	101
Mountain States pwr., com.†	18	....	....
NASSAU & SUFFOLK LTG., 7% pf.	108	98	105
National Carbon, 8% pf.	a137	130½	137½
National Elec. Pwr., A†	a 24½	....	....
National Elec. Pwr., 7% pf.	a 96	....	....
National Lt., Ht. & Pwr., com.	24	....	....
National, Light, Ht. & Pwr., 5% pf.	70	....	....
National Pwr. & Lt., pf.—$7—no par	104½	101½	106½
National Pwr. & Lt., com.†—no par.	22½	19½	23½
National Pub. Serv., 7% pf.	k94½	93	96
National Pub. Serv., 7% pfe., pf.	113	108	115
National Pub. Serv., A com. $1.60—no par.	22	18½	22½
National Pub. Serv., B com.—no par	18½	14	20
Nebraska Pwr., 7% pf.	i109	106	108½
Nevada-Calif. Elec., com.	30	24½	30
New Brunswick Pwr., 7% pf.	55	....	....
New Eng. Pub. Serv., pr. ln. pf. $7..	99½	98½	101
New Eng. Pub. Serv., pf. $7.	95	95½	97
N. J. Pwr. & Lt., 6% pf.	92	....	....
New Orleans Pub. Serv.—7% pf.	104½	103	105
N. Y. & Queens Elec. Lt. & Pwr., 5% pf.	90	....	....
N. Y. Central Elec., 7% pf.	102	102	104
Newport News & Hampton Ry., Gas & Elec., 5% com.	109	....	....
Newport News & Hampton Ry., Gas & Elec., 7% pf.	109	....	....
Niagara Falls Pwr., 7% pf.—25.	k28½	27½	29
Niagara, Lock. & Ont. Pwr., 7% pf.	111	110½	113
No. Amer., 6% pf.—50.	51½	50	52
No. Amer., com.—10.	47½	45½	50½
No. Amer. Edison, $6 pf.—no par.	100½	96½	101
No. Caro. Pub. Serv., pf.—$7—no par	95	93	97
Northeastern Pwr., com.	1o½	15	18½
No. Indiana Gas & Elec., 7% pf. A.	103	102	104
No. N. Y. Utilities, 7% pf.	104	103	105½
No. Ohio Pwr., com.—no par.	11	9½	13½
No. Ohio Trac. & Lt., 6% pf.	80	78	81
No. Ohio Trac. & Lt., 7% pf.	90	90	93
No. Ont. Lt. & Pwr., 6% pf.	k 90	84	90
No. Ont. Lt. & Pwr., 4% com.	74	73	78
No. States Pwr., 7% pf.	102½	100½	104½
No. States Pwr., (Del.) 8% com.	112½	109½	114
No. Texas Elec., 6% pf.	68	65	70
No. Texas Elec., 4% com.	39	27	36
OHIO BRASS, com. B $4—no par.	80	74	85
Ohio Brass, 6% pf.	102	100	103
Ohio Gas & Elec., 7% pf.	100	95	97
Ohio Pwr., 6% pf.	101	96	99
Ohio Pub. Serv., 6% pf.	k 95	95	96½
Ohio Pub. Serv., 7% pf.	104½	103	105½
Ohio River Edison, 7% pf.	106½	103	105½
Oklahoma Gas & Elec., pf.	99	....	....
PACIFIC GAS & ELEC., 6% pf.	25	....	....
Pacific Gas & Elec., 8% new com.	32½	31	33
Pacific Pwr. & Lt., 7% pf.	i103	102	104
Parr Shoals Pwr., 6% pf.	92	....	....
Penn Cent. Lt. & Pwr., $5 pf.—no par ex. div.	c 75	....	....
Penn-Ohio Edison, 7% pf.	101	98	101½
Penn-Ohio Elec., 7% pf.	100	98	100
Penn-Ohio Pwr. & Lt., 7% pf.	101	99	102
Penn-Ohio Pwr. & Lt., 8% pf.	111	109	112
Penn Pwr.& Lt.—$7—no par.	i108½	107	108½
Penn. Pub. Serv., 6% pf.	87	....	....
Penn Wtr. & Pwr., 8% com.	e182½	176	185
Phila. Co., 6% pf.—50.	k50½	50	53
Phila. Co., com.—50.	106	85½	110
Phila. Elec., 8% com.—25.	c 48½	....	....
Portland Elec. Pwr., 7% pf.	98	97½	100
Portland Elec. Pwr., 6% pf.	76	....	....
Portland Elec. Pwr., 6% 2d pf.	55	68	70
Portland Elec. Pwr., com.	20	28	30
Potomac Elec. Pwr., pf.	i108½	....	....
Pwr. Corp. of N. Y., com. $1—no par	m 79	....	....
Pwr. Sec., pf.—no par.	28	28	33
Pwr. Sec., com.—no par.	k 6	5	8
Public Serv. of Colorado, 7% pf.	m99	99	99
Pub. Serv. of N. J., 7% pf.	114½	108½	115½
Pub. Serv. of N. J., 8% pf.	k126½	125	127½
P. S. of N. J., $5 com.—no par.	36½	32	36½
Pub. Serv. of No. Ill., 6% pf.	a105	102	105
Pub. Serv. of No. Ill., 8% com.	a115	113½	116
P. S. of No. Ill., com. $8—no par.	a133½	130½	136
Pub. Serv. of No. Ill., 8% com.	a134½	132	136
Pub. Serv. of Okla., 7% pf.	98½	99	100½
Pub. Serv. Elec. & Gas, 6% pf.	105	102	105½
Pub. Serv. Elec. Pwr., 7% pf.	k116½	113½	116½
Puget Sound Pwr. & Lt., 7% pf.	107	105	107
Puget Sound Pwr. & Lt., 6% pf.	85	....	....
Puget Sound Pwr. & Lt., com.	28½	28½	33½
RADIO CORP. OF AMER., pf.—50.	51½	50½	53
Radio Corp. of Amer., com.—no par.	46	42½	56½
Republic Ry. & Lt., pf.	k120	....	....
Republic Ry. & Lt., com.	k122	112	135
Rochester Gas & Elec. 7% pf. B.	106	105	107
Rochester Gas & Elec., 6% pf. D.	k103	101	103½
Rochester Gas & Elec., 6% pf. C.	103	101½	103½
SAFETY CABLE, com. $4.	60	52½	64½
San Joaquin Lt. & Pwr., 7% pf.	107	105	108
St. Joseph Ry., L., H. & P., 5% pf.	70	70	73
Servel Corp.	k7½	7½	10
Sierra Pacific Elec., com.	24	....	....
Sioux City Gas & Elec., 7% pf.	103	99	101½
Southeastern Pwr. & Lt., pf.—$7 no par	i103½	....	....
Southeastern Pwr. & Lt., $6 pfe. pf.	k 77	....	....
Southeastern Pwr. & Lt., com.—no par.	31	29½	32½
So. Calif. Edison, 8% pf.	36½	36½	38
So. Calif. Edison, 7% pf.	27	27½	28½
So. Calif. Edison, 6% pf.	24	24½	25½
So. Calif. Edison, 8% com.	33½	31½	34½
Southern Cities Utilities, 7% pf.	90	81	86
Southern Cities Utilities, com. $4.	39	....	....
Southwestern Lt. & Pwr., A $3.	63	60	65
Southwestern Lt. & Pwr., B.	63	60	65
Southwestern Lt. & Pwr., $6 pf.	85	83	86
Southwestern Pwr. & Lt., 7% pf.	k106	103	105½
Springfield (Mo.) Ry. & Lt., 7% pf.	99	95	100
Standard Gas & Elec., 8% pf.	k 59½	57½	60
Standard Gas & Elec., 7% pf.	i107½	....	....
Standard G. & E., com. $3—no par.	55½	54	58
Standard Pwr. & Lt., 7% pf.	99½	98	100
Staten Island Edison, pf.—$6—no par.	101	99	101
Superheater, $6 com.—no par.	174	....	....
Syracuse Lighting, 7% pf.	105	103	107
Syracuse Lighting, 8% pf.	115	....	....
Syracuse Lighting, 8% com.	300	....	....
TAMPA ELEC., com. $2.	61	....	....
Tenn. Elec. Pwr., 6% pf.	94	92	94½
Tenn. Elec. Pwr., 7% pf.	105½	103	106½
Terre Haute, Ind. & East. Trac., 5% pf.	20	20	25
Terre Haute, Ind. & East. Trac., com	1	1	3
Tex. Pwr. & Lt., 7% pf.	i108½	106	108
Tide Water Pwr., 8% pf.	105	105	108
Timken Roller Bear., com.—$4 no par.	k 89½	78	95½
Toledo Edison, 8% pf.	115½	115	118
Toledo Edison, 7% pf.	k107½	105	108½
Toledo Edison, 6% pf.	k 95	95	97
Toledo Edison, 6% com.	k100	....	....
Tri-City Ry. & Lt., 6% pf.	95	90	97
UNITED GAS & ELEC., 6% pf.	99	98	99½
United Gas & Elec., com.—no par.	m 57	....	....
United Gas & Elec. (N. J.) 5% pf.	70	70	73
United Gas Impr., 8% com.—50.	c 98	....	....
United Lt. & Pwr., pf.—$4—no par.	50½	49	53½
United Lt. & Pwr., pf.—$6.50—no par.	91½	87	93½
United L. & P., com. A .48—no par.	13½	12½	15½
United L. & P., com. B .48—no par.	a 16	....	....
Utah Pwr. & Lt., 7% pf.	i106½	104	105
Utica Gas & Elec., 7% pf.	k105½	105	106½
Utica Gas & Elec., 8% com.	200	....	....
Utilities Pwr. & Lt., 7% pf.	92½	93	98
Utilities Pwr. & Lt., com. A $2.	28½	27	30½
Utilities Pwr. & Lt., com. B $1—no par.	14½	13½	15½
VERMONT HYDRO-ELEC., 7% pf.	96½	95	97½
Virginia Elec. & Pwr., 7% pf.	107	105	107
Virginian Pwr., 7% pf.	108	....	....
Virginian Pwr., com.	70	....	....
WAGNER ELEC., 7% pf.	b 75	68	76½
Wagner Elec., com.†—no par.	b 23	18½	24
Washington Ry. & Elec., 5% com.	j212	....	....
Washington Ry. & Elec., 5% pf.	j 91½	....	....
Washington Wtr. Pwr., 8% com.	140	136	140
West Mo. Pwr., 7% pf.	m92	....	....
West Penn Elec., 7% pf.	106½	102	107½
West Penn Elec., Cl. A $7.	102	97½	103
West Penn Pwr., 7% pf.	114½	111	115
West Penn Pwr., 6% pf.	104	100½	105½
West Virginia Lt., Ht. & Pwr., 7% pf.	93	94	96
West Va. Utilities, 7% pf.—50.	50	48	51½
Western Pwr., 7% pf.	99	98	101½
Western States Gas & Elec., 7% pf.	96½	96	98
Western States Gas & Elec., com.	18	....	....
Westinghouse Elec. & Mfg., 8% com.—50.	76½	67½	76½
Weston Elec. Instrument, Cl. A $2.01—no par.	k 33½	30½	34½
Weston Elec. Instrument, com.—no par.	17	15	18½
Wheeling Elec., 6% pf.	100	95	97
Wis. Pwr., Lt. & Ht., 7% pf.	k 95	95	97
Worthington Pump, 7% pf. A.	k 53½	46	54½
Worthington Pump, 6% B.	42½	40	45
Worthington Pump, com.	31½	20½	31½
YALE & TOWNE com. $5—25.	k 74½	70½	76

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid price Saturday, April 2. lBid price Wednesday, April 6. mLatest quotations available. †Dividend rate variable.

increase the authorized amounts of preferred and common stock. If approved by the stockholders, the common stock without par value will be issued share for share in exchange for the present $10 par value common stock. The company is not now contemplating the issuance of any additional stock except common stock which will be issued from time to time in payment of dividends.

Midland Utilities Stock Offered.—The first public offering of a 6 per cent cumulative prior lien stock of the Midland Utilities Company was made recently when 15,000 shares were issued. This is a block of an authorized 25,000 shares, and the additional shares are to be offered in the near future to replace the present 10,000 shares of 7 per cent prior lien which have been purchased by the company. The stock will be sold at $92.50 and will yield about 6.50 per cent.

Eastern Shore Utility Company Revises Charter. — Stockholders of the Eastern Shore Gas & Electric Company, Inc., at a meeting held March 7 voted to revise the corporation's charter to authorize a recapitulation of its preferred stock and provide for the issuance of 40,000 additional shares of preferred stock. The preferred stock at present outstanding amounts to $710,000 and is held by 1,300 investors. For each share outstanding the revised charter will provide the issuance of one and one-seventh shares of the new issue, paying a net return of 7 per cent annually and having no par value, but having a dissolution value of $100 per share.

Utilities Power & Light to Change Set-up.—Stockholders of the Utilities Power & Light Corporation will vote at a meeting in Richmond April 20 on a proposed increase in preferred stock from 100,000 shares to 300,000 shares, of class A stock from 400,000 to 1,000,000 shares, and of class B stock from 500,000 to 1,000,000 shares.

Japanese Power Company's Income Up.—The Toho Electric Power Company, Ltd., reports for the year ended Oct. 31, 1926, gross operating earnings of $21,393,356, as compared with $19,900,675 in the preceding year. The conversion into dollars was at the rate of 50 cents a year. After operating expenses and depreciation, net operating income was $7,347,789, against $6,608,021, and with other income added gross income available for interest was $9,952,014, against $9,446,325. The balance for dividends and reserves, etc., was $6,741,450. During the latter part of the company's last fiscal year the earnings included the operating results of the properties formerly owned by the Gifu Electric Power Company, which was merged with the Toho company in April, 1926.

Developed Water Power in United States

THE Department of the Interior, through the Geological Survey, reports that the developed water power of the United States in plants of 100 hp. or more was 11,721,000 hp. on Jan. 1, 1927, an increase of 544,000 hp., or about 5 per cent, during 1926. The figures for several recent years, as determined by the Geological Survey, are as follows:

		Hp.
1921	November	7,926,958
1924	March	9,086,958
1925	March	10,037,655
1926	January 1	11,176,596
1927	January 1	11,720,938

The following tables show the distribution of the developed water power in the United States by sections and in a general way the important water-power regions of the country and the activity of development in each, the rank of the leading states in developed water power for different years, and for each state and group of states the total capacity of waterwheels in plants of 100 hp. or more and the capacity in public utility and manufacturing plants.

To this annual summary of developed water power, as published by the Geological Survey, there have been added three diagrams prepared by R. W. Davenport of the Federal Power Commission showing the growth of power development, especially of water-power development, in the United States over a period of years. Two of the diagrams were reproduced in the ELECTRICAL WORLD, for April 2, 1927, on page 743.

A table showing the developed water power for earlier years, by states and groups of states, as well as the potential water power, may be found in the ELECTRICAL WORLD Statistical Issue, Jan. 1, 1927, on pages 60 and 61.

DISTRIBUTION OF DEVELOPED WATER POWER IN UNITED STATES, 1910, 1921, 1924-1927

Division	Percentage of Total in United States					
	1910	1921	1924	1925	1926	1927
New England	24.6	16.5	15.3	14.0	13.3	13.1
Middle Atlantic	22.1	18.7	19.1	19.4	17.9	17.5
East North Central	9.7	9.3	9.1	8.8	8.8	8.6
West North Central	5.1	5.6	5.1	5.1	4.7	4.6
South Atlantic	8.8	13.6	14.3	15.8	15.2	15.7
East South Central	0.7	3.1	3.8	4.0	6.7	7.4
West South Central	0.2	0.2	0.2	0.3	0.3	0.3
Mountain	7.4	10.4	9.7	9.3	8.8	8.8
Pacific	21.4	22.6	23.5	23.3	24.5	24.0

RANK OF THE TEN LEADING STATES IN DEVELOPED WATER POWER, 1910, 1921, 1924-1927

State	1910		1921		1924		1925		1926		1927	
	Rank	Per Cent of U. S. Total	Rank	Per Cent of U. S. Total	Rank	Per Cent of U. S. Total	Rank	Per Cent of U. S. Total	Rank	Per Cent of U. S. Total	Rank	Per Cent of U. S. Total
New York	1	20.5	1	16.3	1	17.0	1	17.1	2	15.7	2	15.0
California	2	14.1	2	14.5	2	16.0	2	15.3	1	16.4	1	16.4
Maine	3	8.8	4	5.7	4	5.2	6	4.7	7	4.4	7	4.5
Massachusetts	4	5.1	6	4.3	10	3.8	10	3.4				
New Hampshire	5	4.9										
Wisconsin	5	4.7	7	4.2	6	4.4	7	4.1	8	4.0	8	4.0
Minnesota	7	4.2										
Washington	8	4.2	3	5.7	3	5.3	3	5.6	3	5.9	4	5.6
Oregon	9	3.8										
Georgia	10	3.0	10	3.5	7	4.0	8	3.9	9	3.9	9	3.8
Alabama									4	4.8	3	5.6
Montana			5	4.3	9	3.8	9	3.6	10	3.4	10	3.2
North Carolina			9	4.2	5	4.7	4	5.3	5	4.8	6	4.6
South Carolina			8	4.2	8	3.9	5	5.1	6	4.6	5	4.9
Total		73.16		66.9		68.1		68.1		67.9		67.6

Change in Par Value of Stock Authorized.—The Massachusetts Department of Public Utilities has approved the change in the par value of the United Electric Light Company's capital stock — $4,000,000 — from $100 a share to $25 a share, four new shares to be issued in exchange for each old share held.

DEVELOPED WATER POWER IN THE UNITED STATES JANUARY 1, 1927

(Plants of 100 hp. or more)

Division and State	Total		Public Utility and Municipal		Manufacturing and Miscellaneous	
	Number of Plants	Capacity in HP.	Number of Plants	Capacity in HP.	Number of Plants	Capacity in HP.
United States	3,390	11,720,983	1,565	9,961,202	1,825	1,759,781
New England	1,221	1,535,468	264	779,449	957	756,019
Middle Atlantic	613	2,055,853	239	1,757,413	374	298,440
E. North Central	369	1,009,915	250	770,424	119	239,491
W. North Central	201	532,894	150	436,450	51	96,444
South Atlantic	341	1,841,197	161	*1,600,339	180	240,858
E. South Central	60	867,638	45	863,681	15	3,957
W. South Central	29	32,333	18	28,828	11	3,505
Mountain	245	1,030,224	196	1,010,743	49	19,481
Pacific	311	2,815,461	242	2,713,875	69	101,586
New England:						
Maine	250	525,509	78	222,570	172	302,939
New Hampshire	244	277,252	62	143,711	182	133,541
Vermont	196	200,157	66	156,501	130	43,656
Massachusetts	348	353,939	33	171,977	315	181,962
Rhode Island	59	30,188	5	3,285	54	26,903
Connecticut	124	148,423	20	81,405	104	67,018
Middle Atlantic:						
New York	529	1,757,355	186	1,474,100	343	283,255
New Jersey	34	18,902	10	8,658	24	10,244
Pennsylvania	50	279,596	43	274,655	7	4,941
East North Central:						
Ohio	24	30,320	16	25,236	8	5,084
Indiana	24	56,156	16	52,341	8	3,815
Illinois	31	94,202	16	77,277	15	16,925
Michigan	128	355,261	108	307,080	20	48,181
Wisconsin	162	473,976	94	308,490	68	165,486
West North Central:						
Minnesota	69	274,589	47	196,271	22	78,318
Iowa	49	179,580	40	177,980	9	1,600
Missouri	7	20,560	5	20,260	2	300
North Dakota	1	245	0	0	1	245
South Dakota	9	19,671	5	7,050	4	12,621
Nebraska	43	21,335	38	20,532	5	803
Kansas	23	16,914	15	14,357	8	2,557
South Atlantic:						
Delaware	3	1,161	0	0	3	1,161
Maryland	15	37,875	4	33,825	11	4,050
D. of Columbia	2	1,350	0	0	2	1,350
Virginia	62	138,046	32	96,432	30	41,614
West Virginia	12	91,279	7	81,174	5	10,105
North Carolina	122	542,618	47	*410,556	75	*132,062
South Carolina	59	571,428	32	543,321	27	28,107
Georgia	62	448,670	36	426,381	26	22,289
Florida	4	8,770	3	8,650	1	120
East South Central:						
Kentucky	6	34,255	3	33,351	3	904
Tennessee	31	174,175	24	172,920	7	1,255
Alabama	23	659,208	18	657,410	5	1,798
Mississippi	0	0	0	0	0	0
West South Central:						
Arkansas	4	15,550	4	15,550	0	0
Louisiana	0	0	0	0	0	0
Oklahoma	4	1,948	4	1,948	0	0
Texas	21	14,835	10	11,330	11	3,505
Mountain:						
Montana	31	376,040	29	374,100	2	1,940
Idaho	52	320,097	45	317,095	7	3,002
Wyoming	10	10,480	9	10,154	1	326
Colorado	60	95,554	32	84,401	28	11,153
New Mexico	7	1,808	7	1,808	0	0
Arizona	9	59,360	9	59,360	0	0
Utah	67	153,435	57	150,675	10	2,760
Nevada	9	13,450	8	13,150	1	300
Pacific:						
Washington	75	656,722	68	630,590	7	26,132
Oregon	82	241,759	47	185,387	35	56,372
California	154	1,916,980	127	1,897,898	27	19,082

*Two plants with total of about 140,000 hp. considered manufacturing plants in previous reports allocated to public utilities in this report.

Outlying possessions:

Alaska	†40,000	Porto Rico	†15,000
Hawaii	32,224		

†1925; figures for 1927 not available.

Manufacturing and Markets

Means of Improving Manufacturing Facilities

Two booklets on improving manufacturing facilities have been issued by the Boston Chamber of Commerce through its bureau of commercial and industrial affairs. The booklets cover fields for improvement, simplification and standardization, progressive manufacture, modern ideas on working conditions, routing, scheduling and dispatching, manufacturing control and other subjects. They touch on some of the major items of manufacturing and describe good practice and the present state of the art, having especially in mind points of recent development. They also indicate some of the ways by which productive performance in such cases may be measured as simply and as definitely as is being done daily in the case of financial measurements.

One of the things that the booklets point out is that a great many of the more progressive industries are now purchasing electric power from the public service company, but there are a number of old steam-driven plants still in operation that can profit materially by the purchase of electric power. In discussing the industrial application of electric heat the report states that the adoption of electric heat by many industries is by reason of advantages which it offers to the user, and that the metal-working industries are by far the largest users of electric heat, although many other industries have specialized applications utilizing it. On the advantages of good lighting the report says that today the factory executive looks upon good lighting as a sound economic investment. The booklets are available for manufacturers throughout New England and elsewhere.

Standard Speeds for Machinery

Standardization on a national scale of the speeds of machinery is proposed by the National Electrical Manufacturers' Association in a request to the American Engineering Standards Committee to take the matter up with the purpose of simplifying and clarifying the existing situation, which is said to constitute a serious burden on industry through the resulting waste and confusion.

In making the request the association says: "Under present conditions the curve of the speeds of driven machinery is practically a random distribution without any logical ordering of the values used. As a result of this the sizes of pulleys, gears, sprockets, etc., which manufacturers have to produce and which manufacturers, jobbers, dealers and users must keep in stock have been multiplied almost endlessly. While the need for simplification of driving and driven connections has been apparent for years, particularly to producers of electric motors, steam engines, etc., nothing has been accomplished, because without co-ordination and standardization of the speeds of driven and driving machinery considered together, no satisfactory solution can be obtained."

It is the view of the electrical manufacturers that the proposed standardization, which should result in a relatively small number of co-ordinated speeds for the almost innumerable kinds of machinery, would afford an easy approach to the problem of simplification and standardization of pulleys, gears, sprockets, etc., and would permit much greater flexibility in the selection and use of both power units and driven machinery, greatly promoting interchangeability of such units and providing economies for innumerable industries dependent upon such equipment. As the first step, the American Engineering Standards Committee will convene a general conference of the principal trade associations, technical societies, and other groups interested in this subject.

Hand-to-Mouth Buying

A Natural Factor in Industrial Growth—Provides Most Effective Rate of Turnover—Restriction of Buying Carried Too Far Is Harmful

THE practice of hand-to-mouth buying, which is becoming the normal condition of present-day business, has worked a hardship in some instances, but the ill effects of it have been caused mainly by the desire of some to stick to the old method and not to admit the urgency and force of the new. An ideal industrial set-up combines volume, mass production, narrow margins, high output per man through the use of machinery, and constant production, rather than seasonal variation, in order to keep the immense investment in plant and machinery operative. The doctrine of maximum use becomes the dominant doctrine, and what is called hand-to-mouth buying is that doctrine applied to the dollars invested in inventories. Hand-to-mouth buying is thus a natural factor in our industrial growth, and a factor that has been developing gradually over a period of years. Such are the opinions expressed in the recent conference on hand-to-mouth buying sponsored by the policy holders' service bureau of the Metropolitan Life Insurance Company at Chicago.

An Unfortunate Phrase

"Hand-to-mouth buying" is an unfortunate phrase with which to endeavor to describe buying that results in the most effective rate of turnover. "Current buying," "distributed buying," "buying according to need" and "fast-rate-of-turnover buying" are four alternatives. The term "hand-to-mouth buying" came into use as a slur when restrictions on inventories were carried too far following the 1920 depression. In its actual meaning the expression connotes a lack of prudent forethought, which is just what controlled buying should not involve. Restriction of buying is often carried too far in some lines of manufacturing, but such extremes are harmful and open to censure and differ radically from logical buying according to need.

Buying according to need requires an efficient transportation system. Some of the outstanding results of controlled buying come as a result of the efficiency with which the railroads are today operating. There is reason to believe that at least a billion dollars has been released as the fruits of this very effective combination. Controlled buying thus seems to be a permanent development, aside from interruptions now and again, and its roots go far back of post-war developments into the marvelous changes characteristic of the growth of the country into the leading industrial nation of the world.

What the Banker Thinks

The new trend in buying, through providing funds for commercial and industrial use, has made the sum total of the banker's work easier, for it has resulted in the economical and uninterrupted use of a moderate volume of credit, thus making less the urgency of the peak-demand periods and rendering less pronounced the easiness of the seasonally easy period. With excess producing capacity throughout the country and with no likelihood of transportation being other than excellent hand-to-mouth buying will henceforth be the normal method.

There are a great many economical reasons why this method of buying should be permanent. A steady, high volume of production at a low cost is very material to general prosperity, and the practice of current buying has probably done away with commodity speculation, brought about a closer relationship between producer and consumer and made for a more moderate use of capital. Under the new order, capitalization must from time to time be shifted from one element of an industry to another, and it is the chief function of the banker to see that the financial structure of each business is changed so that it can effectively and fully meet a new condition and at the same time make a profit on the additional risk undertaken. This will re-

sult in economical and uninterrupted use of a moderate volume of credit which is relatively easy for the banker to provide.

Effect on Machinery Industry

The equipment industry is in a distinctly different position from that of any industry making consumer goods. In a broad sense the equipment manufacturers always have had a hand-to-mouth business, and probably it will continue so. It is rare indeed when any one can be induced to buy machinery on the sole argument that the time to buy is when costs are low and builders can make prompt deliveries and are willing to sacrifice profits to hold an organization together. Generally such an argument will produce no business out of a plant if it is not running up to capacity. Nearly all manufacturers buy machinery only if and when they think they will be able to use it rather promptly in producing goods at a profit. If that happens to be when business is dull in the equipment industries, a shrewd buyer can perhaps obtain some bargains, but he is not buying because of low prices but rather because of actual need of the machinery. No class of industry can be helped more than the equipment industries by stabilization of general buying, as industrial machines cannot be stocked safely owing to the possible introduction of new designs.

Occasionally the complaint is heard that business in the last few years has not been what it ought to be. Actually the facts will show that the average business has been better than in any other corresponding period, and probably the plant was not fully occupied because it was a peak-load plant able to handle a rush of business when it came in a spurt. When customers insist on buying in spurts, plant facilities must match the customers' habit of buying.

The steel industry considers that there are many arguments that can be advanced which are decidedly favorable to small-lot buying, but such arguments relate principally to the distributor or fabricator and the ultimate consumer. The steel producer has not found it possible to apply hand-to-mouth buying to his supplies of iron ore, coal, limestone and the other principal items which constitute his inventory. He must lay in these supplies months in advance. This is particularly true of iron ore. He must stand ready with a complete stock of raw materials sufficient to insure continuous operation, and the size of the inventory cannot be related in any way to the size of the orders which may be received for production.

Sales Statistics on Direct-Current Motors

Orders entered for direct-current motors show a steady decline since the month of September and orders entered in January, 1927, were the lowest recorded since that time. The average monthly orders placed during 1926 amounted to about $844,600. Orders entered during February showed an increase over those of January.

ORDERS ENTERED AND SALES BILLED FOR DIRECT-CURRENT MOTORS

(1-hp. to 200-hp. inclusive, built in general-purpose motor frames, including control equipment sold with motors and excluding spare parts.)
(Issued by National Electrical Manufacturers' Association—Apparatus Division)

Month, 1926	Orders Entered	Billings
January	$815,976.75	$934,124.01
February	878,028.36	807,281.31
March	1,167,748.91	1,027,318.84
April	866,858.52	821,946.62
May	740,231.54	793,832.28
June	904,269.40	928,272.41
July	740,424.22	876,257.25
August	792,613.03	876,296.67
September	937,913.01	745,782.97
October	801,035.97	837,214.13
November	745,628.53	897,262.36
December	744,424.39	907,971.45
Year to date....	$10,135,152.63	$10,453,560.30
Month, 1927		
January	$692,583.41	$766,011.11
February	731,425.94	671,207.81

Business Conditions

SALES during the first three months of 1927 are somewhat less than for the same period last year in equipment as well as jobbing lines. In the case of specialty manufacturers selling mainly to the utility field orders, in most cases, for the first quarter of this year have shown an increase. Business is proceeding at a fairly steady rate despite this decrease, and manufacturers are confident regarding the future. Some large orders have been placed in the Middle West and Southeast. One sale covered more than $1,000,000 worth of power transformers and another called for 1,000,000 lb. of aluminum wire. There has been a recession in industrial buying except on the Pacific Coast, where sales to such companies continue good, but a number of inquiries received from such sources indicate better conditions.

In New England small orders make up a good total of trade, and although industrial orders have lagged somewhat, inquiries are gaining and prospects are better. Industrial electric heating activity is high, and both street and industrial lighting equipment are in active demand. Buying is tapering off in the New York district and is generally dull. Industrial plants continue to place orders in fair volume. In the Southeast active power apparatus sales were recorded and covered the placing of orders for a 45,000-kw. water-power plant in North Carolina, $60,000 worth of automatic substation equipment for Louisiana, $40,000 worth of power transformers and oil circuit breakers for Mississippi and $35,000 worth of motor-generator and switching equipment for Alabama. Important contracts closed in the St. Louis district include one for a 12,500-kva. turbo-generator unit amounting to over $200,000. Indications are encouraging for good spring business. The volume of business in the Middle West was appreciably larger than was anticipated and some large orders were placed. There was an increased demand for code wire, and from the jobbers' viewpoint sales have improved. On the Pacific Coast industrial buying continues good and many interesting inquiries are also being received. Orders are expected to be placed within a short time for 114 motors, from 750 hp. down, for a fiber mill; $100,000 worth of switchboards and control apparatus for a paper mill in southwestern Washington, and another paper company plans the early purchase of equipment for its proposed plant in Hoquiam.

Non-Ferrous Metal Markets Dull—Prices Decline

Domestic markets for the major non-ferrous metals have been dull, and even zinc and lead sales, which had been moderately active in recent weeks, were quiet. Although some sellers were asking 13¾ cents in the East for copper, this price has been shaded on small sales in the last two days. Five weeks have now gone by with an exceedingly small volume of sales in the copper market. The entire tonnage sold during the last five weeks is little more than half that which changed hands in the single record-breaking week of February. Sellers are convinced that a large volume of buying must be piling up and that when the ice is broken business will be brisk. On the other hand, the attitude of buyers is that although the present price is low it may go still lower, and they are prepared to wait a little longer at any rate. If a material curtailment in production has been effected, as is believed to be the situation, when the March statistics are released buying may become active. It is not likely that a decline in refined stocks will be disclosed, but a lower rate of production should be shown and perhaps a decline in output of blister. On Tuesday one interest that was anxious to sell a limited tonnage cut the price to 13 cents.

The American Smelting & Refining Company again reduced its contract price for lead to 7¼ cents. The reduction followed several very quiet days in a market which has been disappointing for several weeks. Although buying has been exceeding limited prices for zinc have eased only slightly. Galvanizers are reluctant buyers and in some instances have asked that April shipments be deferred. Tin business has been largely between dealers though consumers took a little interest in the market on Tuesday.

NEW YORK METAL MARKET PRICES

	Mar. 30, 1927 Cents per Pound	April 6, 1927 Cents per Pound
Copper electroylte	13¼	13–13.05
Lead, Am. S. & R. price	7.45	7¼
Antimony	12¼–½	12½
Nickel, ingot	35	35
Zinc spots	6.875	6.85
Tin, Straits	68¾	69¼
Aluminum, 99 per cent	26	26

Base copper price April 6, 1927, 15½ cents.

Small Orders Give Good Total in New England District

While industrial orders have lagged somewhat in the New England district, inquiries are gaining and prospects point to a turn for the better. The volume of requests for quotations on large-capacity motors has increased, and orders for small motors attained about the same level as the previous week, reaching a total of about $50,000. Transformer sales are reasonably active, and additions to requirements for substations in southern Vermont and eastern Massachusetts are noted in several orders for small switches and control apparatus. Central-station supplies are attracting interest and considerable wire is being sold. A number of orders of interest were reported for wire, cross-arms and line hardware. Insulator sales are steadily growing and the demand for cable is strong.

Industrial electric heating activity is high, and two orders for heating furnaces of 30-kw. capacity were received. Both street and industrial lighting equipment are in active demand. Electric appliance sales are gaining, with refrigerating apparatus showing a strong upward trend in sales volume and oil-burning equipment installations 25 per cent higher than the level of last year.

Buying Tapers Off in New York District

Public utility buying in the New York district is generally dull, and only a small volume of inquiries is reported. Transformer sales are quiet, following a decrease in the demand for the distribution sizes, and one manufacturer reports last month's business considerably lower than in previous months. No important change has been evident in other lines during the past ten days. Reports generally indicate that the volume of business for the first three months of this year is somewhat less than for the same period last year, and there was a falling off in sales during March. Industrial buying continues in fair volume, with general-purpose motors of medium size retaining their importance. Control-apparatus sales are improving, and a considerable demand for motors for refrigerating machines and pumps is apparent. The demand for conduit, fittings and other wiring materials remains steady.

Slight Acceleration of Sales in Middle West

A slight acceleration of business is noticeable in the Middle West, and the volume was appreciably larger than anticipated. Encouraging reports from the railroad companies indicate a larger movement of commodities. Increased activity among industrial plants and utility companies was noticeable. Cable manufacturers have apparently increased their volume of business as deliveries quoted now are thirty days as compared to fourteen days several weeks ago. Construction work continues with an expenditure of more than $5,000,000 by two properties of the Insull group. Among the interesting orders placed were one for 1,000,000 lb. of aluminum wire, another for 28 20,000-kva. oil-insulated power transformers valued at over $1,000,000, another for fourteen 1,000-kva. transformers valued at over $50,000, and another for twelve 250-kva. induction regulators and 54 1,200-amp., 15-kv. oil circuit breakers. A steel company recently placed orders for switching equipment and transformers to complete the electrification work at its new mill. Business conditions from the jobber's viewpoint have improved somewhat. There has been a better demand for code wire, one jobber placing an order for approximately $10,000 worth of this commodity.

Important Contracts Closed in St. Louis District

An order has been placed in the St. Louis district for a 12,500-kva. turbo-generator unit for one of the larger power companies at a contract price of more than $200,000. One of the manufacturing plants in south St. Louis also bought six 50-hp. synchronous motors at a total cost of about $5,000, and the sale of a 150-kw. motor-generator to one of the mining companies in the southeast Missouri lead district was reported at a price of $3,500. Indications are still encouraging for good spring business, judging from the amount of small orders and inquiries for larger machinery. Quotations have been requested for high-tension transmission-line material, including 6,000 insulators, by a power company in the western part of this district. The impression throughout the electrical industry is that the continued rainy weather has had a depressing effect on early spring business.

Industrial Business in Good Volume on Pacific Coast

Industrial business continues good on the Pacific Coast and includes such representative inquires as those for $3,000 worth of motors and switches for a brick company, $2,000 worth of wiring supplies and 2,500 ft. No. 4 three-conductor cable for a mining company, $2,500 worth of wiring supplies and $1,500 worth of high-tension insulators and pins for a lumber company, and pole-line equipment for a cement company. Several power apparatus and machinery orders have also been placed. Power-company inquiries include $3,000 worth of pole-line material, one-half carload of No. 4 hard-drawn bare copper wire for eastern Nevada, one carload of 65 ft. and 70-ft. poles, and also 2,000 35,000-volt insulators with steel pins. Government business has included telephone equipment for Forest Service Bureau lines. Railroad inquiries have covered approximately $15,000 worth of lead-covered cable, $15,000 worth of train-dispatching equipment and 15,000 ft. of guy wire. Outstanding dealers' business includes an initial order of 250 fans from San Joaquin with probable subsequent orders for several hundred more, and, in addition, such business covered floodlights and much special and standard equipment.

In Seattle and the Puget Sound district there were no large sales reported, but there were a number of individual orders of small size. Some of the orders placed include one for 30 1-kw. generator sets for Alaska fishing boats, ten pumping-plant motors averaging 20 hp. each for the Yakima fruit district, a 150-hp. motor and a 1,500-gal. automatic fire pump for a Tacoma lumber mill. The sale of two carloads of conduit for a fiber mill at Longview was also announced, and it is expected that this plant will soon place orders for about 114 motors from 750 hp. down for its fiber mill and shops nearing completion. Another order which will be placed shortly will involve motors, switchboards and control apparatus for a paper mill in southwestern Washington and will amount to about $100,000. A paper company is also expected to place orders for electrical and other paper-mill machinery totaling about $500,000 for a proposed plant in Hoquiam. The Washington Water Power Company's budget for 1927 calls for the expenditure of $4,500,000 for construction and renewal work, involving new distribution lines, a substation, improvements to its Monroe Street power station in Spokane and other work. A street lighting system in Vancouver, Wash., is being planned at a cost of $68,000.

Active Power Apparatus Sales Recorded in Southeast

Business is active in the Southeast, with the past two weeks showing a marked improvement in the trade. The outstanding sales covered the placing of orders for a 45,000-kw. water-power plant in North Carolina, the equipment orders including generators, transformers, switching equipment and appurtenances amounting to $400,000. Some other interesting central-station orders received in the past ten days were one from Louisiana for $60,000 worth of automatic substation equipment and the other from Mississippi for power transformers and oil circuit breakers amounting to $40,000. The western part of the territory was also represented in the receipt of an order last week from Alabama for motor-generator equipment and switching equipment totaling approximately $35,000. Despite slow conditions in Florida, a reasonable amount of business is coming from that state, the largest single order received recently being for oil circuit breakers and power transformers aggregating $40,000. Besides these large individual orders there is a very satisfactory volume of small and moderate-sized orders for virtually all lines of electrical materials, diversified as to territorial origin.

Industrial electrification and construction is reflected in the demand for substation equipment, which is reported very satisfactory, one manufacturer receiving orders for three substations ranging in size from 500 kw. to 800 kw. and costing from $5,000 to $10,000 each. Motors in sizes up to 50 hp. are in good demand, though few large single orders for this equipment are reported. Fan contracts are being received in reasonably satisfactory number, one of the larger jobbers reporting his fan contracts this year more than 20 per cent in excess of those for 1926, and shipments on these contracts have already been made to the southern part of the section.

Activities of the Trade

Changes in the Staff of Wesco Supply Company

Colonel John L. Buchanan, who for more than seven years has been president and general manager of the Wesco Supply Company, with headquarters in St. Louis, is leaving there for Kansas City, where he will be director of the Midwest General Electric Supply Company of Omaha and Des Moines and the B-R Electric Supply Company of Kansas City. Under his executive guidance the Wesco company has expanded to cover a territory reaching 400 miles wide east and west and from Keokuk, Iowa, to the Gulf of Mexico. The new president and general manager of Wesco is W. R. Herstein, who has 26 years experience as an electrical jobber. He has been for some years president and owner of the Electric Supply Company of Memphis and for the last four years vice-president of Wesco.

Dudlo Manufacturing Corporation Adds to Plant Facilities

Owing to an increasing volume of business, the Dudlo Manufacturing Corporation, Fort Wayne, Ind., manufacturer of magnet wire and coils, has found it necessary to add many new enamel and cotton insulating machines. The company is also installing equipment for producing square and rectangular wire and flexible copper cables. The plant has been equipped with a new conveyor system to accelerate the handling of materials through the various departments, and a new wire mill, which has been recently completed, will be devoted exclusively to the drawing and insulating of magnet wire. The Eastern office of the company is now at 56 Earl Street, Newark, N. J., where a branch factory for winding coils is being operated in conjunction with the warehouse stock of wire. This step was taken to give quicker service to the New England and Atlantic States.

General Electric Company Reports Best Year in 1926

The thirty-fifth annual report of the General Electric Company for the year ended Dec. 31, 1926, shows that for more than 27 years cash dividends have been paid continuously on the common stock. For 26½ years ended July 15, 1926, the rate was uniformly $8 per share per annum, with an extra Red Cross dividend of $1 per share in 1917. The last two quarters of 1926 were at the rate of $3 per share per annum on the new no par value stock, equivalent to $12 per share on the old $100 par value stock. In addition to cash dividends the following distributions of stock, per share of General Electric common stock, have been made during the last 24 years: 30 per cent in common stock in 1912, 2 per cent in common stock in 1917, 4 per cent annually in common stock from 1918 to 1921, inclusive, 5 per cent annually in special stock from 1922 to 1925, inclusive, 1 share of Electric Bond & Share Securities Corporation stock in 1924 and $1 in special stock in 1926. The special stock has a par value of $10 per share and pays 6 per cent annual dividends.

Orders received during 1926 were $327,400,207, compared with $302,513,380 in the year 1925, an increase of 8 per cent. Unfilled orders at the end of 1926 were $72,297,000, compared with $77,860,000 at the end of 1925. The company's income account is shown in the accompanying table:

GENERAL ELECTRIC INCOME ACCOUNT STATEMENT

	1926	1925
Net sales billed	$326,974,103.84	$290,290,165.97
Less: Cost of sales billed, including operating, maintenance and depreciation charges, reserves and provision for all taxes	289,878,335.40	257,479,490.61
Net income from sales	$37,095,768.44	$32,810,675.36
Income from other sources:		
Income from associated companies	$4,937,901.17	$3,411,292.02
Income from miscellaneous securities	915,835.86	751,142.69
Interest and discount	3,047,048.71	2,838,513.87
Income from U. S. Government securities	2,647,502.31	2,394,398.77
Royalties and sundry revenue	1,013,238.27	964,720.54
	$12,561,526.32	$10,360,067.89
Total income	$49,657,294.76	$43,170,743.25
Less: All interest payments and, in 1925, premium on debentures retired	$436,511.81	$1,925,696.99
Addition to general reserve	2,548,284.31	2,603,828.81
	$2,984,796.12	$4,529,525.80
Profit available for dividends	$46,672,498.64	$38,641,217.45
Less: 6 per cent cash dividends on special stock	2,357,614.20	1,735,576.20
Profit available for dividends on common stock	$44,314,884.44	$36,905,641.25
Less: Cash dividends on common stock*	19,828,896.75	14,407,544.00
Surplus for the year	$24,485,987.69	$22,498,097.25
Surplus at January 1	85,848,170.72	72,362,223.47
	$110,334,158.41	$94,860,320.72
Less: Dividends paid in special stock: $1 per share in 1926 (equivalent to $4 per share on old $100 par value stock) and $5 per share in 1925	7,210,810.00	9,012,150.00
Surplus at December 31	$103,123,348.41	$85,848,170.72

* At the rate of $8 per share on old $100 par value stock in 1925 and first half of 1926 and at the rate of $3 per share on new no par value stock (equivalent to $12 per share on old stock) in last half of 1926.

The company states that the number of stockholders of both classes at Dec. 15, 1926, was 46,305 (of whom nearly one-half were women) and included residents of every state in the Union. Less than 2 per cent of the stock was held in foreign countries.

The export business of the company is conducted by the International General Electric Company, Incorporated. Those portions of its orders and billing which were for General Electric products are included in the corresponding figures of the General Electric Company at their cost to the International company. The total of all orders received by the International company during the year was $20,824,000, compared with $25,710,000 during 1925. The net sales billed were $22,696,577.37 during 1926, compared with $21,981,951.56 for 1925. The International company's business yielded a profit available for dividends of $1,538,306.99, compared with $2,617,204.18 in 1925. Dividends of $1,500,000 were paid during 1926, of which the General Electric Company received $1,375,772, which is included in the financial statement as part of "income from associated companies."

Westinghouse Gets Orders from Commonwealth Edison

The Commonwealth Edison Company, Chicago, has placed with the Westinghouse Electric & Manufacturing Company two orders for converters and transformers. The first order includes four 13,000-amp., 60-cycle booster converters with four 3,940-kva. transformers. This equipment will be used to supply additional power to the Edison direct-current system. Two of the units will be of the semi-inclosed type with an inclosure over the commutator end only. The other two units will be totally inclosed and forced ventilation will be used. The second order calls for two 3,000-kw., 60-cycle, 600-volt railway converters and two 3,000-kva. transformers. These units will be used to supply power to the surface and elevated lines and will make a total of six units of this capacity now in use.

Co-operative Refrigeration Plans Formed on Pacific Coast

Plans for a co-operative advertising campaign on refrigeration have been devised by the Electric Refrigeration Trades Association of Portland, Ore. The plan proposes drawing together every interest in the city which has anything to do with selling any sort of refrigeration to the public. Thus ice manufacturers and dealers in ordinary ice refrigerator boxes are included as well as those selling electric refrigerators. All these interests are to advertise simultaneously during one week early in May, using the same copy, which will carry the general idea to the public that refrigeration is desirable and necessary.

Principal media for the carrying of

this general message are street cars, space on 450 of which has been donated by the Portland Electric Power Company, truck banners to be placed on all transportation units of all the firms entering the campaign, and large posters for display in stores and windows of the subscribing firms. In addition each entrant is encouraged to run additional newspaper advertising carrying the general copy to tie in with the campaign and also carrying specialized copy pertaining to the particular product sold by that firm, whether it be ice or refrigerators or mechanical refrigeration. Entering firms are to be assessed from $5 to $15 in accordance with their size to cover the cost of the general advertising material and will also pay for as many banners and posters as they can conveniently use. A fairly generous response to the idea has been received, and it is expected that before the campaign starts the cooperation of a large percentage of the refrigeration interests in the city will have been obtained.

Superior Refrigerator Announces Appointment of Officers

W. F. Marr has been appointed general sales manager of Superior Iceless Refrigerator, Inc., Hanna Building, Cleveland, according to an announcement by Edward L. Frantz, executive vice-president of the company. For several years Mr. Marr has acted as an independent sales counselor, and previously he was identified with the American Ironing Machine Company, Chicago, and the United Electric Company, Canton.

Other members of the organization are Charles A. Kolp, Canton, president; C. E. Yates, George Lee Miller, formerly vice-president and general manager of the Gilliam Manufacturing Company, chief consulting engineer, and J. E. Massey, superintendent of the Superior factory at Canton.

Refrigeration Outlook Excellent in New England District

Vigorous development of the electric refrigeration market is under way in New England, and the volume of sales this year will probably exceed past records by at least 50 to 100 per cent. Mild weather is helping spring business to get under way, and sales in both residential and commercial fields are improving. The New England Bureau of Public Service Information recently made a survey of all the states except Connecticut and sixty-seven power companies reported 13,056 domestic and 3,758 commercial machines on their lines, tabulated as follows:

Reports from 67 Companies	Domestic	Commercial
Maine	735	110
New Hampshire	515	192
Vermont	195	13
Massachusetts	10,479	3,377
Rhode Island	1,132	66

At recent meetings of manufacturers' sales organizations in New England the situation was generally declared to be more favorable to good business in this line than ever before. Competition is keen, but the saturation point is far away. The manufacturers are better organized territorially than before, and leading utilities are co-operating in sales policies on a scale that promises excellent results. The New England public is showing more interest in electrical refrigeration, and despite its growth the sale of natural ice in 1926 passed all previous records, showing that the broad advantages of food preservation by artificial cooling have been brought home to the public in a way to establish a firm foundation for 1927 business.

General Electric Company Gets Pacific Coast Orders

A contract for furnishing two 3,000-kva. transformers and several oil circuit breakers ranging from 400 amp. to 600 amp., 15,000 volts, switching equipment, etc., to be installed in the automatic substation to be built by the Puget Sound Power & Light Company on Alaska Street in Seattle, has been secured by the General Electric Company. The Spokane office of the company has also received a large order for electrical equipment for a Coeur d'Alene mine, the award being made by the Bunker Hill & Sullivan Mining Company and involving $100,000. The contract is for equipment for the main portion of the new electrolytic zinc plant under construction west of Kellogg and includes a 10,000-kw. bank of transformers, two 4,000-kw. synchronous motor-generator sets for the conversion of alternating current to direct current for the zinc-cell circuits and switching and control equipment.

The Hoover Company, North Canton, Ohio, manufacturer of vacuum cleaners, announces a national "trade-in" plan, effective at once but established in any city or town only on the approval of the local dealers.

The Olaneta Battery Works, an American concern of Dresden, Germany, has purchased the entire machinery, patents and other assets of the Wilhelm Battery Company, 70 Frost Street, Brooklyn, N. Y., and will operate this plant under the name of the Olaneta Battery Works. The factory, salesroom and office will be at 258 Wythe Avenue, Brooklyn.

The Parr Electric Export Corporation, 77 Warren Street, New York, announces that Philip K. Murdock, 233 Broadway, New York, has merged his business with the Parr corporation, which will henceforth act as export sales managers for the companies formerly represented by Mr. Murdock in addition to those lines now represented by it. For the past two years Mr. Murdock has been acting as combination export manager for the Arrow Electric Company of Hartford, the Chicago Fuse Manufacturing Company of Chicago, the Handel Company of Meriden, Conn., and the electrical appliance division of the Robeson Rochester Corporation, Rochester, N. Y. Mr. Murdock expects to leave on a sales trip to foreign markets in the immediate future on behalf of the Parr Electric Export Corporation.

The W. N. Matthews Corporation, St. Louis, at the annual meeting of the board of directors elected the following officers for the fiscal year ending March 2, 1928: W. N. Matthews, president; Claude L. Matthews, vice-president and treasurer, and M. C. Cooley, secretary.

Harold E. Trent, manufacturer of electrical heating and temperature control apparatus, has removed his office to 439 North Twelfth Street, Philadelphia.

The Appleton Electric Company, 1701 Wellington Avenue, Chicago, manufacturer of "unilets" and other conduit fittings, announces the purchase on Jan. 1 of the complete foundry equipment, buildings and land of the Stowell Company, South Milwaukee, Wis., and is now operating it as plant No. 2 under the name of the Wisconsin Appleton Company.

The Western Electric Company open its new Jacksonville (Fla.) plant recently. W. H. Langer, formerly manager at Savannah, has been made manager of the new plant. The building contains 37,000 sq.ft. of floor space.

The Electric Storage Battery Company, Philadelphia, announces the opening of its newly erected Philadelphia factory branch at 1955 Hunting Park Avenue. The branch, which is under the management of W. C. Hooven, houses a sales department for every type of "Exide" battery and a depot where certain types of batteries are assembled and complete batteries and parts are stored.

The Electric Furnace Company, Salem, Ohio, has received an order from the A. O. Smith Corporation, Milwaukee, for a 3,000-kw. heat-treating and annealing electric furnace for use in the manufacture of oil stills.

The Philadelphia Storage Battery Company, Philadelphia, has leased property at South Turner Avenue and West Forty-seventh Street, Chicago, as a site for a new one-and-two-story branch plant to have about 31,000 sq.ft. of floor space.

The General Electric Company states that more than 25 000 of its employees hold bonds, totaling over $22,500,000, in the General Electric Employees' Securities Corporation, according to the fourth annual report of the organization. This is an average holding of $903, an increase of $143 over 1925 and an increase of 5 per cent in the number of bondholders.

B. J. Carney & Company, producers of Western red-cedar poles at Grinnell, Iowa, for the past 25 years, announce the removal of their offices to 100 North Seventh Street, Minneapolis.

Micarta Fabricators, Inc., 307 Canal Street, New York, has taken over the entire business and personnel of the Accurate Gear Corporation, 273 Sackett Street, Brooklyn, N. Y., and has created a new division of the general sales and engineering departments known as the "Accurate Gear division." Joseph J. Braun has been made chief engineer of the company and general manager of this division. The plant of the Accurate Gear Corporation has been moved to 307 Canal Street, where the

combined companies will have their general offices and plant. Up to the present time the Micarta Fabricators, Inc., have been mostly interested as Westinghouse fabricators and jobbers of "micarta" to the radio industries. From now on the combined companies will cover the entire radio, gear, mechanical, industrial and insulation fields.

The Globe Electric Supply Company, Denver, former jobber for Servel electric refrigerators, is now handling the Coldak machine, according to Paul A. Douden, president of the company. The Servel Corporation, of which W. B. Milliken is divisional manager, has taken over the selling of its products in the Mountain States territory, with division offices in Denver and district offices in Salt Lake City, Utah.

The Electric Refrigeration Corporation, Detroit, in its statement to the New York Stock Exchange for the quarter ended Dec. 31, 1926, shows a net loss of $541,367 after deduction of expenses, interest, etc. The company reports that for the five months from Oct. 1 to March 1, it shipped 16,288 "Kelvinators," an increase of 95 per cent over the 8,364 units that were shipped in the corresponding period a year ago.

The Strand & Sweet Manufacturing Co., Winsted, Conn., manufacturer of magnet wire, is planning an expansion program to double the output of its plant within a year. Increased equipment will be added in existing buildings.

The Robbins & Myers Company, Springfield, Ohio, reports for the year ended Dec. 31, 1926, a net loss of $106,005, after deduction of interest, depreciation and other charges, which compares with a net loss of $257,593 during 1925.

Fairbanks, Morse & Company, Chicago, in their report for 1926 show a net profit of $2,740,386 after the deduction of taxes, depreciation and other charges. This is a decrease of about 9 per cent as compared with a net profit of $3,016,248 in 1925.

The Westinghouse Electric & Manufacturing Company has opened a new branch office in Memphis, where George F. Leake, for several years in charge of the domestic sales department at St. Louis, will be manager. The new office will cover Arkansas, eastern Tennessee and northern Mississippi.

The Radio Corporation of America, Woolworth Building, New York, reports the biggest year in its history in 1926, with a gross business of $60,437,461, which compares with $50,405,144 the previous year. While 1926 was a good year, it had been expected to be even greater, but sales in the last two months did not come up to estimates. Net profits in 1926 amounted to $6,426,599.

The Quimby Pump Company announces a change in address to 340 Thomas Street, Newark, N. J.

The Safety Cable Company, 114 Liberty Street, New York, reports for the year ended Dec. 31, 1926, a net profit of $1,312,716 after deduction of federal taxes, interest, depreciation, etc.

New Equipment Available

Conduit Fittings

A new line of conduit fittings, known as the "Obround condulets," utilizing a new method of fastening the covers or wiring devices, has been developed by the Crouse-Hinds Company, Syracuse, N. Y. The new fastening device is called the wedge-nut fastener. With a few turns of a screwdriver the cover or wiring device is applied, and the manufacturer claims it cannot become loosened by vibration.

With this new form of construction it is said that there are no screws projecting inwardly to injure the conductors, and because of the unobstructed cover opening conductors may be easily pulled without injury to them. The unobstructed cover opening and large wiring chamber make splicing and taping easy. The covers and wiring devices may be conveniently installed even in difficult places as they can be

CROSS-SECTION OF CONDULET, SHOWING METHOD OF FASTENING COVER

turned so as to bring the fastening screws into an accessible position. Being complete units, no parts of cover or wiring devices can be lost during installation. The new Obround condulets are made in many different types for all required uses.

Step-Back Relay

A new step-back relay introduced by the General Electric Company is designed for use in direct-current magnetic control equipment to provide overload protection and to allow a suitable time delay before reset. The relay is a combination of two more or less distinct parts. The upper part consists essentially of a normally closed contact whose open or closed position is controlled by a coil in series with the motor armature. Loads in excess of the relay setting cause this normally closed contact to open, dropping out the step-back and accelerating contactors and thereby inserting enough resistance to limit the motor current to 125 per cent normal full load with stalled armature.

The lower part of the relay prevents the overload mechanism from resetting until after a definite time interval during which time the motor has a chance to become stabilized. If, after this definite time delay, conditions have again become normal and the motor current has decreased to a safe point, the overload mechanism resets and the control panel automatically accelerates the motor in the regular manner. However, unless the current decreases below a certain point, the relay will not reset. In this event the motor will have to be disconnected from the line and restarted from rest. The principal use for the new relay at present is on marine equipments for anchor windlasses and capstans, although it is expected to be of value wherever it is necessary to maintain the torque and at the same time provide overload protection.

Inclosed Ventilated Motor

An inclosed ventilated motor, for installations where fire prevention associations and insurance companies recommend the application of an inclosed motor on account of fire hazards from inflammable dust or explosive vapors, has been developed by Fairbanks, Morse & Company, 900 South Wabash Avenue, Chicago. The motor, known as the type EHJ, is also intended to be used where the conditions of service are unusually severe, as in the case of excessive humidity and temperature or in heavily dust-laden atmospheres.

The machine is of the double squirrel-cage type, requiring no starting compensator, and is completely inclosed by a rigid cast-iron frame without the use of any sheet-metal covering. Flanged inlet and outlet openings are provided for the attachment of ventilating ducts. The motor is said to have a starting torque of 200 to 250 per cent of that developed at rated load and a starting current less than 450 per cent of full-load current.

Electric Hoist

A new "Lo-Hed" electric hoist that can be mounted in a fixed position, either overhead or on the ground, or can be placed on skids and used as a portable hoist has been developed by the American Engineering Company, Philadelphia. Uses for the hoist include applications for contractors' work, derricks, as a car puller, mine hoist, elevator work, ash handling, coal tipples, loading booms, etc. The standard machine consists of a smooth drum, driven by a motor through a train of spur gears, all mounted on a common bedplate. It is furnished in sizes for handling loads from 500 lb. to 4,500 lb. The motor and gears are completely inclosed, and Hyatt high-duty roller bearings are used. The motor, furnished for either direct or alternating current, is a fully inclosed, ball-bearing unit, especially designed for hoist service. The controller is of the single-speed, reversing-drum type.

Plug-Fuse Type Panelboard. — Two new types of panelboards of the plug-fuse type, particularly applicable to apartments, hospitals, hotels and office buildings, has been placed on the market by the Westinghouse Electric & Manufacturing Company. These panelboards are said to be compact and to permit of easy installation. They are known as types JF and NJF.

New Trade Literature

VALVES.—The Coffin Valve Company, Neponset, Mass., is distributing section 4-B of its general catalog, entitled "Electric Operation of Valves," and giving a description of the Kelty motor-drive unit, on which patents are pending. Section 3-A of the general catalog issued by the company describes the Dow disk arm-pivot valve, on which patents are pending, used as a check valve in pump-discharge lines.

LIGHTING ARRESTERS.—Bulletin No. 234 issued by the Electric Service Supplies Company, Seventeenth and Cambria Streets, Philadelphia, covers its Keystone crystal-valve and the neutral lightning arresters. This bulletin contains a description of the general construction and application of the Keystone crystal-valve lightning arresters. Dimensional diagrams are included. Attention is also called to the Garton-Daniels types of lightning-arrester ground fittings.

COIL-WINDING APPARATUS. — The P. E. Chapman Electrical Works, corner Tenth and Walnut Streets, St. Louis, is distributing bulletin No. 35 describing the Chapman compensating tensionless magnet wire "dereeler," designed for use with any winding machine or lathe. Illustrations are given showing various applications of the device.

AUTOMATIC ARC WELDING.—The General Electric Company, Schenectady, N. Y., is distributing bulletin GEA-586 entitled "Automatic Arc Welding" in which it calls attention to the various applications for automatic arc welding, such as ice-cream cans, oil barrels, hot-water boilers and oil and gasoline storage tanks. It also contains an illustration of the first all-electrically arc-welded water-pipe line in the world.

POLE-LINE CONSTRUCTION TOOLS. —The Leach Company, Oshkosh, Wis., is distributing a catalog covering the "Oshkosh" pole-line construction tools. All tools are illustrated as well as described.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase and agency are desired in Dittersdorf Loessnitz, Germany (No. 24,845), for electrical household appliances.

Purchase and agency are desired in Berlin, Germany (No. 24,868), for electrical household and industrial machines.

Purchase is desired in Hamburg, Germany (No. 24,873), of electrical household and restaurant appliances.

Purchase is desired in Hamilton, Canada (No. 24,867), of electric motors with coal-burning blowers.

Purchase is desired in Prague, Czechoslovakia (No. 24,851), of electric welding machines for a metal-furniture factory.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

Middle Atlantic States

BROOKLYN, N. Y. — Plans have been prepared by Stevins & Wood, Inc., 129 Broadway, New York City, for a power plant for the Bush Terminal, foot of Forty-third Street, to be erected at Thirty-fourth Street, Brooklyn, to cost about $850,000.

INLET, N. Y. — Permission nas been granted the Inlet Utilities Company to build an electric plant in Inlet. The company plans to supply electricity in Eagle Bay and adjacent territory in the Fulton Chain, as well as in Inlet.

KINGS PARK, N. Y.—Bids will be received by the Department of Mental Hygiene, Capitol, Albany, until April 13, for refrigerating equipment, Building O, Veterans' Memorial Hospital, Kings Park Hospital, Kings Parks.

LONG ISLAND CITY, N. Y. — Plans have been prepared by the National Sugar Refining Company, Front Street, for a sugar refinery and power plant, to cost about $1,000,000.

NEWTON FALLS, N. Y. — Preliminary plans have been started by the Newton Falls Paper Company for the construction of a new dam and power plant.

NEW YORK, N. Y.—Extensions of the automatic traffic light system throughout the important thoroughfares of the boroughs of Manhattan, Bronx, Brooklyn and Queens to regulate traffic at 1,143 additional street intersections has been provided for in an appropriation of $494,000 approved by the Board of Estimate.

NEW YORK, N. Y.—Five hydro-electric developments on the Racquette River are contemplated by the Northeastern Power Corporation, 47 Wall Street, New York City. Four of the developments are to be made at Norfolk, East Norfolk, Norwood and Raymondville, where the paper mills of the St. Regis Paper Company are located. A total of about 15,000 hp. will be developed at the four mills. Another is to be located at South Colton on the Upper Racquette River. This plant will have an initial capacity of 13,000 hp., with an ultimate of 39,000 hp. A fourth unit is to be installed at Taylorville, increasing the output of the plant by 1,800 hp.

ORANGEBURG, N. Y.—Bids will be received by the Commissioner of Mental Hygiene, Department of Mental Hygiene, Capitol, Albany, until April 20, for construction, heating, sanitary and electric work for buildings No. 1 to 25 inclusive, for the Rockland State Hospital, Orangeburg.

ROCHESTER, N. Y.—Ordinances have been adopted by the City Council for additional lighting on Main Street East and West from Broad Street to East Avenue, to cost about $18,180; on Lyell Avenue, $7,354; and for Charlotte Street, $2,103. Ordinances have been submitted to the Council for additional lighting in Main Street East from North Goodman Street to Culver Road, to cost about $12,960, and for North Street, from Main Street to the New York Central Railroad, to cost $19,780.

MORRISTOWN, N. J.—The installation of an improved lighting system in the center of the town, to cost about $23,000, is under consideration by the Community Lighting Committee. The Jersey Central Light & Power Company furnishes electrical service here.

WHIPPANY, N. J.—Preparations have been made by the Jersey Central Power & Light Company, Morristown, for the erection of a 66,000-volt, steel tower transmission line between Whippany and the Boonton, Morristown and Summit sections. Pending the completion of the tower line, arrangements have been made to connect Whippany by a short extension to the existing lines which supply Morristown and Summit.

ALLENTOWN, PA. — Bids will be received by the School Board, Administration Building, 31 South Penn Street, until April 18, for twenty-four electric motors, complete with starters. etc. T. P. Wenner is secretary.

WASHINGTON, D. C.—The Supply Office, Navy Yard, has been authorized to purchase a motor-generator in the open market. (Req. NSA 980.)

North Central States

AKRON, OHIO. — The Northern Ohio Power & Light Company plans to install an ornamental lighting system on Main Street, to cost $87,000. The company plans extensions and improvements in the underground conduit system in the downtown section. to cost about $137,000.

CAMP PERRY, OHIO.—Bids will be received by the Adjutant General's Department, State House, Columbus, until April 26, for a refrigerating and cold storage plant at Camp Perry (Circular 1).

AURORA, ILL. — Plans have been announced by the Western United Gas & Electric Company for placing all wires in the business district underground with larger transmission wires between Aurora and Glen Ellyn, rebuilding five electric feeders and installing equipment in the Aurora plant for the use of pulverized coal. The cost of the improvements is estimated at $1,300,000.

APPLETON, WIS. — The Wisconsin Traction, Light, Heat & Power Company contemplates the erection of a transmission line to Sherwood to serve farmers along Highway 55.

CUDAHY, WIS.—The City Council has appropriated $13,850 for the installation of an electric police-alarm system.

EAU CLAIRE, WIS.—Through the erection of the remaining 37 miles of transmission line (Western red cedar poles) a new power loop system will be placed in operation by the Northern States Power Company between Neillsville and Colby, tieing in its power lines running from Wissota to Abbottsford and another via Eau Claire to Neillsville.

FOND DU LAC, WIS.—The Wisconsin Power & Light Company, Madison, plans to rebuild its transmission line between North Fond du Lac and Fond du Lac, and other improvements to cost about $15,000.

KENOSHA, WIS. — Two branch transmission line extensions will be erected west from the high-tension transmission line, now under construction between Kenosha and Waukegan by the Wisconsin Gas & Electric Company and the Public Service Company of Northern Illinois. One line will be built via Gurney to Lake Geneva and the other between McHenry and Woodstock.

LADYSMITH, WIS. — Permission has been granted the Lake Superior District Power Company to extend its high-tension transmission line from Brooklyn down the Gates Road to Highway 14, permitting a tie-in with the high-tension line running to Bruce.

OCONTO, WIS. — Permission has been granted by the County Commissioners to the Wisconsin Public Service Corporation, Green Bay, to erect a 13,000-volt transmission line to serve the towns of Morgan, Chase, Spruce, Kelly Lake, Hickory Corners, Suring, Sampson and adjacent territory within the county.

RIPON, WIS.—The Wisconsin Power & Light Company, Madison, plans to erect about 16 miles of rural lines to serve farmers in the Ripon district.

BRUNSVILLE, IOWA.—The Iowa Light, Heat & Power Company, Carroll, which is negotiating for the purchase of the municipal electric plant, contemplates extensions in its tranmission lines in this section.

DAVENPORT, IOWA. — Permission has been granted the Peoples Light Company to erect a transmission line from the west limits of the city to the plant of the Dewey Portland Cement Company on the Buffalo highway.

KEOKUK, IOWA.—Plans are under way by the Mississippi River Power Company, a subsidiary of the North American Company, for increasing the output of its plant at Keokuk dam by 40,000 kw., at a cost of about $2,500,000. Hugh L. Cooper, 101 Park Avenue, New York City, is consulting engineer.

BUELAH, N. D.—The Hughes Electric Company, Bismarck, has awarded contract for extensions and alterations to its local plant. to cost about $60,000, to John Larson, 202 Third Street, Bismarck.

ARAPAHOE, NEB. — The Nebraska Power Company, Omaha, has acquired the municipal electric light plant, which furnishes electric service here and in Edison. The company plans to erect a transmission line from its plant in Orleans to Edison to furnish local service.

MONROE, NEB.—A franchise has been granted the Northwestern Public Service Company, Columbus, to supply electricity in Monroe. The company will extend its transmission line from Duncan to furnish service here.

NELIGH, NEB.—The City Council has granted the Neligh Electric Light Company, a subsidiary of the Western States Utilities Company, Lincoln, a franchise to install an electric plant and distribution system including an ornamental lighting system in Neligh, subject to the approval of the voters. The equipment will include two Diesel driven generating units of 300 hp. each.

Southern States

ATLANTA, GA.—The Georgia Power Company, which has acquired the municipal electric systems in Metter, Stillmore and Statesboro, will erect a 44,000-volt transmission line from Swainsboro to Statesboro, via Metter and Stillmore about 40 miles long. Distribution systems will be built with substations of 450 kva., 150 kva. and 100 kva. in Statesboro, Metter and Stillmore respectively.

COHUTTA, GA.—The Georgia Power Company, Atlanta, which has acquired the municipal electric plant, will rebuild the local system.

ST. PETERSBURG, FLA.—Steps have been taken by the Greater Ninth Street Association for the installation of an ornamental lighting system on Ninth Street.

ELDORADO, ARK.—The City Council has authorized the Mayor to contract with the Arkansas Power & Light Company for the installation of an ornamental lighting system in the business district, consisting of 151 metal standards mounted with lamps of 300 cp.

CANTON, OKLA.—Bonds to the amount of $20,000 have been voted for extensions to the light and water plant.

ALPINE, TEX.—Plans are underway by the Central Power & Light Company, San Antonio, for the installation of a new street-lighting system covering the entire city. Arc lamps are to be erected in the residential districts and ornamental lamps in the downtown district.

ALVIN, TEX. — The Western Public Service Company, San Antonio. plans to erect a high-tension line from Lamarque to Alvin.

AUSTIN, TEX.—Bids will be received by the Board of Regents, University of Texas, until April 18, for the construction of a power plant at the institution. The Herbert M. Green Company, Santa Fe Building, Dallas, is architect.

FORT SAM HOUSTON, TEX.—Bids will be received by the office of the quartermaster, Fort Sam Houston, until April 15, for electric motors, switchboard and electrical accessories, with centrifugal pumping equipment (Circular 62).

HOUSTON, TEX.—At an election to be held April 11 the proposal to issue $150,000 in bonds for extensions to the fire-alarm and traffic-light system will be submitted to the voters.

WICHITA FALLS, TEX.—Plans are under way by the Texas Electric Service Company for the erection of a high-tension transmission line between Wichita Falls and Breckenridge, 100 miles long, to cost about $275,000; also to erect a substation at Graham, to cost $75,000, and to enlarge substations at Archer City, and Holiday, at a cost of $20,000.

Pacific and Mountain States

SEATTLE, WASH.—A permit has been granted the Puget Sound Power & Light Company for the construction of a substation at 220 West Alaska Street, to cost about $20,000.

BEVERLY HILLS, CAL.—The installation of an ornamental lighting system on portions of Country Club and Roxbury Drives, to cost about $25,000, is under consideration.

BURLINGAME, CAL.—The City Council is considering the installation of a fire-alarm system.

CHOWCHILLA, CAL.—The San Joaquin Light & Power Corporation, Fresno, plans extensions and improvements in its transmission and distributing lines in this section, to cost about $296,000.

CULVER CITY, CAL.—The City Council has authorized the installation of an ornamental lighting system on portions of Tuller, Globe, and Huntley Avenues, and Sawtelle Boulevard.

FONTANA, CAL.—The Southern California Edison Company, Los Angeles, plans to erect a transmission line from San Bernardino to this section, about 10 miles, to cost about $120,000.

LOS ANGELES, CAL.—Bids will be received by the Board of County Supervisors, Court House, until April 18, for the installation of an ornamental lighting system in the Graham Lighting District.

MARIPOSA, CAL.—The San Joaquin Light & Power Corporation, Fresno, plans to build a substation on the Merced River, for service at the new mill of the Yosemite Portland Cement Company.

ORANGE, CAL. — The Southern California Edison Company, Los Angeles, is planning extensions in its transmission lines in this section, to cost about $100,000.

PASADENA, CAL.—The Southern California Edison Company, Los Angeles, plans to build a substation on Garfield Avenue, to cost about $130,000.

SAN FRANCISCO, CAL. — The War Department has approved the application of the Great Western Power Company, to lay an 11,000-volt power transmission cable under the waters of Oakland Inner Harbor in Tidal Canal between Alameda and Oakland.

SALT LAKE CITY, UTAH.—The Utah Power & Light Company has applied to the Federal Power Commission for a license to erect a 132,000-volt transmission line from its Wheelon station to the plant of the Idaho Power Company at American Falls, a distance of 82 miles. The cost is estimated at $500,000.

AKRON, COL. — The Commonwealth Utilities Corporation, Denver, which has acquired the local electric plant, is planning to erect a high-tension transmission line from Akron to Otis. The company also plans to build a high-tension line between Genoa and Limon.

STERLING, COL.—An expansion program covering a period of two or three years and involving an expenditure of about $1,000,000 has been announced by the Public Service Company of Colorado, Denver, for improvements to its local plant and distribution lines in this territory.

CARLSBAD, N. MEX.—The Southwestern Public Service Corporation plans to install an additional generating unit in its local plant.

Canada

QUEENSTON, ONT.—The Hydro-Electric Power Commission of Ontario, Toronto, plans to build a new transformer station here, to cost about $100,000.

TORONTO, ONT.—The Hydro-Electric Power Commission of Ontario is considering the construction of a large transformer station in the eastern part of the city or in East York Township to distribute electricity from the Gatineau development in the Toronto territory.

TORONTO, ONT.—Supplementary estimates for expenditure for the Hydro-Electric Power Commission of Ontario have been passed by the Provincial Legislature as follows: For the Niagara system, $50,000; for the Georgian Bay system, $50,000; the Central Ontario system, $125,000, and for St. Lawrence, $10,000.

QUEBEC, QUE.—The Des Quinze Power Company has applied to the Public Service Commission for permission to erect a 90,000-volt transmission line to connect Kirkland Lake, Ont., with Boischatel, Que., passing through the towns of Boischatel and Dasserat in the Temiscamingue district.

Electrical Patents

Announced by U. S. Patent Office

(Issued March 15, 1927)

1,621,032. COMMUTATION OF SYNCHRONOUS CONVERTERS; E. B. Shand, Pittsburgh, Pa. App. filed April 11, 1922. To compensate for the variable effects produced by the wattless component of the alternating current flowing in the armature of a rotary converter and for variations in the angular position of the rotor.

1,621,039. ANGLE RING FOR TRANSFORMERS; A. W. Thompson, East McKeesport, Pa. App. filed Jan. 14, 1921. To provide a spacing strip member of suitable form to be cut into the desired lengths and wrapped around a coil and secured in place in any preferred manner.

1,621,050. REGULATOR SYSTEM; J. H. Ashbaugh, Pittsburgh, Pa. App. filed May 28, 1925. In which the regulation is effected by rapidly opening and closing a circuit in shunt to a resistor located in the field-winding circuit of an exciter.

1,621,052. BANDING MACHINE; V. D. Barker, Wilkinsburg, Pa. App. filed June 14, 1923. For banding the rotors of dynamo-electric machines with banding material. Adapted for banding steel wire on rotating bodies at a uniform tension, irrespective of variations in the periphery of the bodies being wound.

1,621,056. THERMAL RELAY; W. W. Bradshaw, Wilkinsburg, Pa. App. filed Nov. 5, 1923. That shall have such a time interval in the operation thereof as to afford protection to electrical apparatus against continued overloads.

1,621,058. ELECTRIC CONDENSER; O. Burger, Berlin-Charlottenburg, Germany. App. filed Feb. 10, 1925. In an electric condenser, the combination of a dielectric layer, conducting layers at both sides of the dielectric layer and a layer of semi-conducting protective material between the dielectric and one of the conducting layers of considerably greater thickness than the dielectric layer.

1,621,068, 1,621,069, 1,621,070. ELECTRIC ARC WELDING AND CUTTING SYSTEM; C. J. Holslag, South Orange, N. J. Apps. filed Feb. 9, 1923, and Oct. 8, 1924. Having an open-core reactor for starting and a closed-core reactor for welding.

1,621,171. ELECTRIC HEATER AND STOVE; J. J. Libi, San Francisco, Cal. App. filed July 8, 1924.

1,621,173. OVERLOAD DEVICE FOR ALTERNATING-CURRENT MOTORS; C. H. Rippl, Cleveland, Ohio. App. filed Aug. 18, 1926. Particularly of the induction-motor type. To provide with a hot wire, tripping or circuit-breaking device an overload device, preferably in the form of a reactor in parallel with the hot wire, which will handle the high starting currents and at the same time allow the hot wire to function in its usual manner for other overload currents.

1,621,214. PERIODIC ROTARY SWITCH; W. N. Olson, Chicago, Ill. App. filed April 22, 1925.

1,621,233. CONTROLLING DEVICE; H. E. Campbell, Milwaukee, Wis. App. filed Jan. 7, 1924. For controlling current to small electric motors used for running sewing machines and the like.

1,621,246. INSULATOR; W. T. Goddard, Hamilton, Ontario, Canada. App. filed Oct. 1, 1921. High-tension insulators; the method of connecting metallic members to insulating sections.

1,621,279. APPARATUS FOR CONTROLLING AND DISTRIBUTING ELECTRIC CURRENTS; E. Roucayrol, Paris, France. App. filed Dec. 30, 1922. To a plurality of electrodes in therapeutic applications.

1,621,280. IMPULSE SYSTEM OF CONTROL; E. Roucka, Blansko, Czechoslovakia. App. filed Aug. 20, 1923. A system of controlling any value, such as a quantity or condition, through sudden changes or impulses of auxiliary energy produced at different time positions in regular intervals of time, the time positions determining the controlling action.

1,621,290. POSITION INDICATOR; H. L. Tanner, Brooklyn, N. Y. App. filed March 24, 1920. Used to signal or transmit from one point to another.

1,621,327. RACK FOR BATTERY PLATES; S. A. Lehman, Fort Wayne, Ind. App. filed June 26, 1925. A support in which battery plates may be treated while they are held in insulated spaced relation, the bulging of the insulating material being avoided.

1,621,340. ROTARY SNAP SWITCH; G. B. Thomas, Bridgeport, Conn. App. filed July 13, 1921.

1,621,341. LOCKING ATTACHMENT FOR INCANDESCENT LAMPS; T. B. Vogt, Passaic, N. J. App. filed April 2, 1921.

1,621,349. ELECTRIC FUSE; G. R. Brown, Bridgeport, Conn. App. filed July 20, 1926.

1,621,360. INCANDESCENT LAMP; R. N. Falge, Cleveland, Ohio. App. filed April 22, 1922. For projection purposes.

1,621,364. ATTACHMENT PLUG AND RECEPTACLE; G. W. Goodridge, Bridgeport, Conn. App. filed July 23, 1921.

1,621,368, 1,621,369. SWITCH-OPERATED MECHANISM; J. D. Hilliard, Schenectady, N. Y. Apps. filed June 1 and Nov. 11, 1922. With an improved mechanism of this character which can readily be incorporated in switches of the types now manufactured.

1,621,394. MECHANICAL INTEGRATING DEVICE AND APPLICATIONS OF THE SAME; C. F. Bertin, Mustapha, Alger, Algeria. App. filed June 27, 1924.

1,621,407. SCROLL-DISPLAYING DEVICE; D. Hill, Porterville, Cal. App. filed Jan. 18, 1926.

1,621,424. ELECTRIC POULTRY PERCH; D. R. McGinnis, Kalispell, Mont. App. filed Feb. 2, 1926.

1,621,429. SERIES-WOUND MACHINE WITH ADDITIONAL EXCITATION IN BRIDGE CONNECTION; W. Petersen, Darmstadt, Germany. App. filed Oct. 27, 1925. Constant voltage is secured by means of a boosting exciting winding which forms an arm of a Wheatstone bridge connected across the main circuit.

1,621,452. MEANS FOR REGULATING THE VOLTAGE OF DYNAMOS OF VARIABLE SPEED AND LOAD; H. Benet, Paris, France. Using a vibrating regulator having two contacts and intended for the regulation of the excitation of dynamos with variable speed or load of the type employed in the lighting of vehicles.

1,621,469. ELECTRIC GENERATOR; B. P. Remy, Indianapolis, Ind. App. filed Dec. 1, 1925. With a single flux-shifting element which has reciprocatory movement in contradistinction to the general practice of rotational movement; a magneto with a reciprocatory movable member.

1,621,481. ELECTRIC CELL; C. Fery, Paris, France. App. filed Sept. 2, 1921.